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Clean Air Strategy for Alberta

Report on the Regional Sessions

Volume III: *Written Submissions*
Part One

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Report on the Regional Sessions

Volume III: *Written Submissions*
Part One

This document is Volume III, part one, of the *Report on the Regional Sessions*. Volume I is the *Moderator's Report*. Volume II is the *Verbatim Transcript* of the public meetings. Volume III, parts one and two, are the *Written Submissions*. Part one is submissions from governments, industry and individuals and part two is from public interest groups and schools. Volume I has wide distribution and may be obtained at the address below. Volumes II and III, parts one and two, are on file at many public libraries for public access and for inter-library loan.

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ALBERTA

Liberal Opposition
Room 204, Legislature Annex
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January 14, 1991

Clean Air Strategy for Alberta
2nd floor, Highfield Place
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Edmonton, AB

Please find enclosed the written submission on the Clean Air Strategy for Alberta, from Grant Mitchell, MLA and Nick Taylor, MLA. The Liberal Caucus looks forward to seeing the Clean Air Strategy drawn up and implemented as soon as possible.

Yours truly,

Mary Griffiths
Researcher

CLEAN AIR STRATEGY FOR ALBERTA

PROPOSALS BY GRANT MITCHELL, MLA

LIBERAL ENVIRONMENT CRITIC

AND

NICK TAYLOR, MLA

LIBERAL UTILITIES CRITIC

January 14, 1991

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1. Introduction

It is important that Alberta develop a Clean Air Strategy, because of global warming, acid deposition and smog caused by burning fossil fuels and the effects these have on human health and life.

Albertans should be especially concerned about the contribution that the province makes to global warming. Although the province has only 0.04% of the world's population we produce about 0.5% of the energy-related carbon dioxide (CO_2) in the world, due to our use of fossil fuels. While a considerable amount of this is due to energy exported to other provinces and states, Alberta has both a moral obligation and an economic incentive to deal with the emissions of CO_2. On the one hand, we have a moral obligation because we have a highly sophisticated, well-educated society that can provide leadership and put us in a strong position to help reduce these emissions, ultimately world-wide. On the other hand, we have a huge economic stake in the burning of fossil fuels, and are therefore extremely vulnerable should world markets shift their demand for fossil fuels out of fear for CO_2 emissions. We must focus our attention of ways of conserving energy, developing non-polluting energy and creating technology that reduces or captures CO_2. By being at the forefront in the field of emission-reduction technologies, and various other initiatives to reduce greenhouse gases, the province can build a more diversified and less vulnerable economy and develop technology that we can sell around the world.

The government's "Clean Air Strategy for Alberta" is concerned with energy-related air emissions. However, air pollution is caused not only by burning fossil fuels but by various non-energy sources such as industrial plants and incinerators. The scope of the Clean Air Strategy should be broadened to cover non-energy air emissions, some of which will be mentioned below.

It is important that the Clean Air Strategy is pro-active, and is designed not only to reduce emissions which are currently of concern, but framed to reduce emissions of various trace elements and other substances. The long term plan should be to eliminate emissions of all substances unless it has been shown that they are harmless.

The public input into the initial phase of the Clean Air Strategy would have been much more productive if the government had outlined a draft strategy for reducing emissions. The documents published in the information package are informative, but give no indication of the actual measures which the government might take. Although some stakeholders may welcome a "carte blanche" to enable them an opportunity to express their vested interests, workshops and public input would have been more productive if participants were able to criticise or make recommendations within the structured framework of a draft government strategy.

The following issues should be given consideration when drawing up the Clean Air Strategy.

2. The Clean Air Strategy and Health

The fundamental reason for introducing a Clean Air Strategy is to protect not only the environment but human health. Traditionally the Department of Environment has been responsible for establishing acceptable standards for air pollution. It is, however, essential that health experts should also be involved, to ensure that emission levels will be strict enough to adequately protect human health.

The Clean Air Strategy should incorporate a definition of health, to provide a standard of what is acceptable. The definition given by the World Health Organization, in the preamble to its constitution, is recommended. It states that health is "A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."

3. Greenhouse gases

The Intergovernmental Panel on Climatic Change has provided definite evidence that the quantities of CO_2 and other greenhouse gases are increasing and that the world is becoming warmer. This United Nations Panel predicts that, based on current model results, continuing with the current "business as usual" policy "will result in a likely increase in the global mean temperature of about 1^0C above the present value by 2025." [1] As an industrialised country Canada produces more gases that lead to global warming per head of population than most other countries and Alberta produces about 22% of energy-related CO_2 emissions in Canada. Alberta should accept responsibility for reducing its share of greenhouse gases and the province must reduce not only levels of CO_2 but also those of other "greenhouse gases" including chlorofluorocarbons, nitrogen oxides (NO_x) and volatile organic compounds (VOC).

3.1 Carbon dioxide

The province should aim to reduce CO_2 emissions to 20% below the 1988 level by the year 2005 (the objective proposed by the World Conference on the Changing Atmosphere[2]).

Alberta should only be directly responsible for emissions of CO_2 produced from fossil fuels consumed within the province, and should lobby the federal government to set up a nation-wide scheme which would make other provinces responsible for their share of the emissions. This could be done under an apportionment system, using tradable pollution credits, that would allow Alberta to "trade" emissions with other parts of the country. Each province would be allowed to produce a certain amount of CO_2, but if a province wanted to buy some of their fossil-fuel-based energy from Alberta, they would have to give Alberta a share of their pollution allowance. Country-wide emissions of CO_2 would continuously be cut back, by reducing the total allowable emissions each year. Thus, each province would have an incentive to help Alberta reduce its emissions by sharing the cost of reducing CO_2 emissions from Alberta-produced fossil fuels that they consume.

There are a wide variety of energy conservation methods for reducing CO_2 emissions in Alberta, but even if all conservation measures examined by the authors of the Alberta Energy Discussion Paper[3] are carried out, the level of emissions in the year 2005 will only be 7% lower than the level in 1988. It will thus be necessary to identify further methods for reducing CO_2 emissions and to consider far-reaching changes, that may involve changes in lifestyle. One aspect of the Clean Air Strategy must be to examine ways to improve urban planning and the transportation system to encourage the use of energy-efficient forms of transport. A list of recommendations is included in "Clouds of Change", the Final Report of the City of Vancouver Task Force on Atmospheric Change.

Various specific methods for reducing the discharge of CO_2 have been outlined in an AOSTRA paper, "The Greenhouse Effect and the Alberta Fossil Fuels Industry" [4]. All six methods which they propose for reducing CO_2 emissions should be adopted, with the most cost-effective measures being introduced first.

3.1.1 Increasing energy efficiency

Energy conservation (e.g. reducing energy consumption by improving insulation and eliminating draughts; using public transport instead of private vehicles) and increasing energy efficiency (e.g. using better-designed, more energy-efficient vehicles, furnaces and appliances) are two important cost-effective ways to reduce the discharges of air pollutants. Measures to encourage energy conservation and energy efficiency should be an integral part of the clean air strategy.

A vehicle registration tax, which penalizes those who buy new vehicles which have a high gas consumption and provides a rebate to vehicles that have low gas consumption should be introduced. This should be phased in by not later than the middle of this decade. Revenue from this tax could also be used to finance a scheme to provide subsidies for the conversion of vehicles to alternative fuels.

Consideration could be given to a scheme such as the Drive + (Demand-based Reductions in Vehicle Emissions) program which has been devised in California[5]. A new vehicle buyer would receive a rebate if the emissions from that model are below the average certified emission standards for all cars sold in the province. This would be paid for by a surcharge on all those cars sold which produce emissions exceeding the provincial average.

The provincial government should cooperate with the federal government to set standards to limit the CO_2 emission from new cars. They should also encourage and undertake research into new, highly efficient urban vehicles powered by hydrogen or other alternative fuels.

Government policy should encourage the co-generation of power. This power can either be used at source or be added to the electricity grid. Utilization of waste heat (e.g. from power stations) should also be developed, for example for district heating.

Stringent energy-conservation building standards should be compulsory for all new buildings, whether residential, commercial or industrial (e.g. requiring that all new residential and commercial buildings are built to at least R-2000 standards, so that they require only 30% of the energy needed to heat conventional buildings). Home-buyers must be encouraged to consider energy efficiency when buying a home and to invest in insulation of existing properties.

Retrofit energy conservation measures would account for about 56% of energy savings between 1988 and 2005 according to an Alberta Energy analysis[3], and although the capital cost would be high, the average payback on investment would be little over 3 years.

The government should thus undertake a public education campaign to stimulate conservation and encourage the installation of the most energy-efficient equipment. If efficient technologies are to be widely deployed, the government or public utilities will need to offer rebate programs to promote the buying of energy-efficient devices (as is already done by more than 60 utilities in the U.S.[6]).

One word of warning is necessary concerning efforts to increase energy conservation. As residential, commercial and institutional facilities increase energy conservation through restricting indoor/outdoor air circulation (measures such as improving air tightness, weather stripping, caulking, air vapour seals), there is a danger of increasing the problem of "Indoor Air Pollution." The number of complaints about indoor air climates have increased during the last decade and the World Health Organization has termed this problem the "Sick Building Syndrome".

Therefore, the Alberta Clean Air Strategy should draw attention to this hazard when making recommendations on improving energy conservation by the above means. Otherwise we may be solving one problem but creating another due to people being exposed to contaminated indoor air (which will result in extra medical expenses, lost man-hours of work, decreased productivity).

3.1.2 Fuel substitution

This involves increasing the hydrogen to carbon ratio of fuels, so that the amount of CO_2 emitted for given energy production is reduced. Using natural gas instead of coal halves the amount of CO_2 produced for a given amount of energy. Propane produces less CO_2 than petroleum gas. The government should start by converting its own vehicles to run on propane or liquid natural gas. This not only reduces air pollution, there is also an economic incentive, as this conversion pays for itself in less than 2 years. Consideration should be given to providing loans or subsidies to encourage vehicle conversion.

Efforts should also be made to increase the percentage of ethanol in gasoline, and to encourage petroleum companies to carry ethanol as a retail product. Ethanol, besides being more environmentally friendly, is also a renewal resource, unlike petroleum products. The use of ethanol on a large scale would also benefit the agricultural sector of Alberta by providing farmers with another market for their grain products.

3.1.3 Reducing CO_2 emissions during production and processing of the fuel

The above-mentioned AOSTRA publication[4] outlines various ways in which this can be done, and the most cost-effective methods should be introduced immediately.

Twenty-five percent of CO_2 emissions from the energy industry come from the oil sands[7]. The CO_2 emissions from the energy sector are expected to grow by over 50% by 2005, largely due to the forecast growth in the oil sands sector. If the government is serious about its Clean Air Strategy, it should not allow the project to go ahead until all air pollution aspects have been resolved. As an interim measure it could be required that each new oil sand plant that comes on stream should have only half the pollution level (per volume of output) compared with the previous plant.

3.1.4 Capturing the CO_2 emissions from fuel combustion

CO_2 can be removed from plants such as coal-fired electricity stations. It is especially important to either reduce or collect CO_2 emissions caused by the generation of electricity as this source contributes nearly one third of the CO_2 produced in the province.

There is a potential to increase the use of CO_2 for the secondary extraction of oil, but this would not utilize all the CO_2 extracted from fuel combustion and other plants. Research is being carried out into ways of storing unwanted CO_2 underground. According to E.J. Wiggins of AOSTRA (personal communication) there is ample scope for such storage, not only in space made available by the extraction of oil or natural gas but in various basins in the western sedimentary strata.

Full support should be given to the current research into extracting and storing CO_2. Inevitably this method of reducing CO_2 emissions will be expensive, but the costs of inaction on global warming may be even higher. Moreover, the consumer will not necessarily face higher electricity costs if full energy-efficiency and conservation measures are adopted.

3.1.5 Tree planting

A provincial tree planting program (perhaps in addition to that proposed by the federal Green Plan) can be a useful means of reducing ambient CO_2 concentrations. In order to reduce annual fluctuations it may be beneficial to plant coniferous rather than deciduous species. It is obvious that with the expansion of the pulp and paper industry and increased logging in northern Alberta, it is essential that replacement planting should at least equal the rate of consumption of old forests.

3.1.6 CO_2 from non-energy sources

CO_2 is also produced from non-energy sources in, for example, the manufacture of nitrogen fertilizer, lime and Portland cement. The scope of the Clean Air Strategy should be extended to enable it take action to reduce CO_2 emissions from such non-energy sources.

3.2 Chlorofluorocarbons

The federal government already has a policy to reduce CFC's, but there is considerable scope for the provincial government. It should be obligatory to collect and recycle or destroy all CFC's from, for example, car air conditioning systems and refrigerators when these are repaired or scrapped. A suitable scheme should be implemented within a year of the introduction of the Alberta Clean Air Strategy.

3.3 Nitrogen oxides and volatile organic compounds

These gases are of concern because at ground level they react with sunlight to form ground level ozone, the third most important contributor to the greenhouse effect.

The provincial government should adopt all measures proposed in the Federal/Provincial Management Plan for Nitrogen Oxides and Volatile Organic Compounds[8]. The province should not be allowed to "water down" any of the regional recommendations, but should start with the most cost-effective.

One of the most cost-effective ways to reduce NO_x and VOC emissions is to undertake a massive energy conservation program (such as is proposed above for reducing CO_2 emissions).

The various methods proposed above to reduce the consumption of conventional fuels used in transportation will also reduce the NO_x and VOC emissions. The province should encourage the federal government to require improved vehicle standards for all new vehicles.

The Clean Air Strategy should be extended to encourage action to reduce VOC emissions from the non-energy sector (e.g. industrial processes in the petrochemical industry).

3.4 Alternative sources of energy

The potential for developing alternative sources of non-polluting energy, such as wind power and solar energy is already being investigated, but more research and development funds should be channelled in this direction. It should be made as easy as possible for small scale suppliers of energy from alternative sources to contribute to the electricity grid. There should also be a "clean air" bonus, as an incentive to those supplying energy by means which do not create pollution, e.g. wind and solar energy.

Research should be encouraged into various types of photovoltaic cells, and non-polluting technologies to produce hydrogen electrolytically. In the long term hydrogen could be a valuable, clean fuel, especially valued as it produces no CO_2, SO_2 or particulate matter.

By encouraging research in alternative energy resources, Alberta could be in the lead with such technologies. We will then not only reduce our own CO_2 emissions, but will be in a position to "export" this knowledge, which will help reduce the impact of any reduction in demand for fossil fuels.

4. Sulphur dioxide

4.1 Sulphur dioxide emissions and health

There is considerable concern about the level of sulphur emissions in the province, and the impact that these can have on health. The most evident source of sulphur dioxide (SO_2) emissions is from the sour gas processing. Although this industry has made major reductions in sulphur emissions, there is still serious cause for concern.

Despite the apparent clear blue skies and clean air in Alberta, the province has the highest asthma rate in Canada. This may not only be a function of emissions, but due to the interaction of particulates and gases. Professor W.C. Hulbert of the University of Alberta Department of Medicine, Pulmonary Defense Group, has pointed out that there is an interactive effect between the concentration of dust particles and SO_2; the health effects of inhaling SO_2 are much greater when particulate levels are high.

Hulbert has drawn attention to information from the Strathcona Air Quality Network[9] which indicates that levels of SO_2 and particulate matter are approaching the threshold where human health could be affected (personal communication). During the summer months suspended particulate levels (resulting from farming activities etc.) exceed the standard of 100 $\mu g/m^3$ by up to a factor of 2. Health problems can result when these high particulate levels combine with either high SO_2 levels or a change in SO_2 levels of more than 25 ppb. In 1989 the maximum levels of SO_2 recorded by the Strathcona Air Quality Network did not occur in the months with high particulate levels, but the levels are sufficient to warrant vigilance. It is probably not possible to reduce particulate levels so efforts should be made to ensure that SO_2 levels are restrained. (See Hulbert's paper[10] for more specific information on this subject.)

Standards for the emission of particulates should aim to reduce the concentration of the smaller particles (less than 2.5 μm in size), as these are the particles that get into the lungs.

4.2 Monitoring

One of the key recommendations of the Alberta Acid Deposition Research Program Advisory Board was that the province should establish a long-term regional air quality monitoring program for the entire province. Obviously this program should not be restricted to monitoring SO_2 and particulate matter but should include a full range of chemical substances released by industrial processes and all forms of fuel combustion, including that from vehicles. The air quality in the main cities and areas of industrial pollution should be announced on the radio each day, and should be accompanied by an assessment of the risk to human health.

Findings on the effect of sulphur emissions on health in Pincher Creek, suggested that chronic low-level exposure to emissions from sour gas plants is sufficient to cause respiratory symptoms among children, even though there is no physiologic change[11]. We also need to know the frequency and severity of any acute effects caused by emissions from such plants.

4.3 Airsheds

Traditional policy has aimed at limiting emissions of undesirable substances from each plant. However, with an increasing number of plants, ambient concentrations can become unacceptably high. Modern meteorology recognizes that air flows in streams, rather like water, so one can have airsheds, which resemble watersheds. One gets a zone of contamination downwind of pollution sources.

The airshed approach to air pollution is a flexible system that allows some variation in emission standards between different industrial plants, while ensuring that total emissions do not pose a threat to human health. The government should investigate ways of introducing the airshed concept for controlling total ambient air pollution levels in certain regions of Alberta where air quality is a cause for concern. The government would set an upper limit on a particular air pollutant within the airshed and each source would be required by a specific deadline to achieve emission reductions equivalent to the amount by which they exceed the government-established baseline figure. If a company wants to exceed this baseline permit level or wants to set up a new plant within an airshed, it would have to buy or trade for a permit from another company, whose emissions are below the baseline standard. The maximum level of emissions permitted within the airshed would be regularly reduced, leading to cleaner air for the entire airshed.

In areas with, for example, a large number of natural gas refineries airsheds should be established which specify the total permissible ambient concentration of total reduced sulphur (SO_2, H_2S and mercaptans), and total particulate matter. However, the airshed concept can obviously be applied for all industrial emissions, not only sulphur.

4.4 Sulphur recovery

Every effort should be made to eliminate sulphur emissions. Currently, the proportion of sulphur recovered from sour gas plants decreases with plant size and only 70% is recovered from small plants producing less than 5 tonnes/day compared with a recovery rate of 99.8% for a plant of 2000 of tonnes/day. Consequently tonnes of SO_2 are currently emitted to the atmosphere, which could be recovered with the best available technology and increases in the recovery rates of sulphur for various plant sizes.

The Alberta Clean Air Strategy should require that the best available technology be used for all plants. It is recognised that it is not economically viable to recover sulphur from small plants, so the government's subsidy scheme (currently available for plants producing between 1 and 5 tonnes per day) should be extended to include those plants producing less than a tonne per day. If necessary, the largest plants covered by the current scheme could be exempted from the subsidy, so that the total government costs for this measure are not increased.

5. Air pollution from non-energy sources

5.1 Biomedical waste and other uncontrolled incinerators

There are approximately 147 small rural biomedical waste incinerators in Alberta, which lack air pollution control devices such as wet/dry scrubbers. Biomedical waste incinerators emit a broad range of contaminants (such as halogenated organic acids, benzene, NO_x, SO_2, hydrogen chloride, chlorine, polychlorinated PAC's, benzo(a)pyrene, particulate matter, lead, cadmium, mercury, and various isomers of dioxins and furans).

On an individual basis, biomedical waste incinerators may not have a large impact on residential airsheds, but the synergistic effect of 147 biomedical waste incinerators on air quality is undoubtedly an environmental health concern.

In California biomedical waste incinerators were given the highest priority for development of dioxin control measures based on emission and exposure potential as:

i. Biomedical waste incinerators have the potential for the greatest individual risk of all sources of dioxins currently identified.

ii. Most of the incinerators are uncontrolled and located in residential areas.

iii. Biomedical waste incinerators are the only known, consistent source of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in California.

Due to the above, the Canadian Council of Resources and Environment Ministers Committee has specifically endorsed a ban on new small scale, residential, commercial and institutional incinerators that are not capable of meeting minimum combustion requirements outlined in their guideline.

The Alberta Clean Air Strategy should thus adopt the policy of the gradual closure of all uncontrolled biomedical and municipal waste incinerators (including school incinerators that burn plastics), or the upgrading of the air pollution control systems on these incinerators to meet the guidelines put forward by the Canadian Council of Resources and Environment Ministers on Incineration and Municipal Solid Waste Disposal (October 1988).

5.2 Pulp Mills and Waste Systems

Attention should also be paid to monitoring and, if necessary, reducing volatile emissions from the handling of industrial wastes and sludge ponds (e.g. municipal sewer treatment plants, pulp mill sludge ponds, and landfills).

A study of the license to operate for a pulp mill (e.g. Daishowa Canada Co. Ltd. at Peace River) indicates that the ambient air quality of the region will be decreased by particulate emission, SO_2 and total released sulphur emission. As development increases in northern Alberta, the airsheds in the region will probably suffer a deleterious effect due to the pulp mill development. The implications of SO_2 and particulate emissions have already been discussed above.

Thus the Clean Air Strategy should come to a definite decision as to which type of air pollution control technology (Best Practical or Best Available) will be used by northern pulp and paper mills. The type of air control technology chosen will certainly have an effect on the amount of SO_2, particulate and total reduced sulphur emissions released into the atmosphere.

6. Pro-active approach

In the past we have always awaited a pollution problem before taking measures to clean it up. We are becoming increasingly aware that even small quantities of some substances can have detrimental effects on the environment and health. Today we recognize that sulphur and particulate matter can be harmful but this was not known 50 years ago. Some trace elements may have harmful effects of which we are not yet aware. Thus one element of the Clean Air Strategy should be concerned with identifying substances, including trace elements, which are potentially harmful, but which are not currently regulated. Moreover, the onus of proof should be on the industrialist to provide evidence that substances are harmless, before they can be discharged. Modern plants, such as oil upgraders, are so large that even if the proportion of some trace substances is very small, the total emission may be a cause for concern. If we can trap CO_2 and store it underground, we should find ways of trapping and storing trace elements such as cadmium, cesium, lead and mercury.

Efforts are being made to reduce and eliminate liquid effluents (e.g. zero-effluent pulp mills are now being built) and we should likewise plan towards a stackless society, with no emissions of toxic products to the atmosphere.

7. Government standards and regulations

Standards for all mobile and stationary engines, and for industrial plants (both energy-related emissions and emissions from other sources) should be set in regulations which are reviewed every 3 years to ensure that the best available technology is used. In some cases annual revision is probably desirable.

Industry should be required to upgrade and use the latest available technology whenever a license is renewed.

As indicated above, the government should adopt a tax system to encourage the use of small motor vehicles, rather than those which have a high gas consumption.

Regular vehicle testing should be required, to ensure that engines create as little air pollution as possible.

Airsheds should be established, within which a cap is put on further emissions of, for example, total sulphur.

A system of tradable emission permits should be considered as an economic way of encouraging industry to reduce emissions.

8. Conclusion

A Clean Air Strategy for Alberta is overdue. It should cover not only energy related emissions but other aspects of air pollution which are of concern in the province. Because there was no draft strategy for discussion at the initial workshop or regional sessions, it is essential that there should be adequate opportunity for public input in Phase 3, the Summary Workshop. The Final Report should be as specific as possible, and each recommendation should include a specific strategy and time-frame for its implementation.

References

1. Intergovernmental Panel on Climatic Change, First Assessment Report, Overview, United Nations Environmental Program/World Health Organization, August 1990.

2. World Conference on the Changing Atmosphere: Implications for Global Security, Toronto, June 1988.

3. A Discussion Paper on the Potential for Reducing Carbon Dioxide Emissions in Alberta, Executive Summary, Energy Efficiency Branch, Alberta Energy, 1990.

4. The Greenhouse Effect and the Alberta Fossil Fuels Industry, A Discussion Paper by E.J. Wiggins and W.J. Yurko, for the Alberta Oil Sands Technology and Research Authority (AOSTRA), 1989.

5. Drive +: A proposal for California to use consumer fees and rebates to reduce new motor vehicle emissions and fuel consumption, D. Gordon and L. Levenson, Applied Science Division, Lawrence Berkeley Laboratory, Berkley, CA 94720, July, 1989.

6. Efficient Use of Electricity, A.P. Fickett, C.W. Gellings and A.B. Lovins, Scientific American, September 1990, p.65.

7. Energy-Related Carbon Dioxide Emissions in Alberta 1988-2005, Energy Efficiency Branch, Alberta Energy, 1990.

8. Management Plan for Nitrogen Oxides and Volatile Organic Compounds, Federal/Provincial Long Range Transport of Air Pollutants Steering Committee, First draft March, 1990.

9. Strathcona Industrial Association, Air Quality Network, Annual Report, 1989.

10. Air Pollution Assessment for the City of Edmonton for the Aurum Landfill, W.C. Hulbert, University of Alberta, Pulmonary Defense Group, 1990.

11. Effects of Natural Gas Refineries on Respiratory Health, American Review of Respiratory Disease, R.E. Dales, W.O. Spitzer et al, 1989, Vol. 139, p. 595-600.

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January 8, 1991

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Dear Mr. Mitchell:

Thank you for the opportunity to participate in the Clean Air Strategy for Alberta. Our response focuses on the question "What should Albertans do to reduce emissions from energy related sources?".

In 1983, the CRPC published a document entitled Land Use Planning for Energy Conservation: Concepts for Community Planning. As energy conservation also reduces the volume of emissions contributing to smog, acid deposition and greenhouse gases, some of the concepts included in that report are applicable to the clean air issue. The CRPC response, therefore, focuses on the second question outlined above.

Land use planning can contribute to the effort to reduce emissions caused by energy use and production in the following ways:

1. An efficient transportation system, including alternatives to the private automobile, urban centres that provide as many services as possible to the local community, and concentrated forms of development help to reduce energy use for transportation.

2. Higher density residential development helps to reduce urban sprawl and improve the efficiency of public transit. In addition if higher densities are achieved by building dwellings with shared walls, energy use for home heating can be reduced.

.../2

3. Provision of safe pedestrian and bicycle routes connecting various destinations would encourage transportation alternatives.

4. Industrial and commercial waste heat can be used by neighbouring buildings.

5. Subdivisions can be designed so that houses can be oriented toward the sun, to make use of passive solar energy.

6. Buildings can be designed to maximize exposure to the sun, through appropriate siting and landscaping, south facing glass, and other design features.

Regional plans and municipal statutory plans and land use by-laws have an important role to play, first to ensure that they do not impede planning for energy conservation and reduction of emissions, and second to encourage consideration of these issues when land use planning decisions are being made.

We hope you will consider these comments in formulating the clean air strategy for the province.

Yours truly,

Michele Broadhurst

Michele Broadhurst, Planner
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MB/jm

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November 21, 1990

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TO WHOM IT MAY CONCERN:

Re: Clean Air Strategy

On behalf of the Crowsnest Pass Economic Development Board, I wish to make a few observations and suggestions which I feel must be considered throughout this process.

All of us are concerned about the environment and as parents and grand-parents we know that what we destroy, the next generation will not have to enjoy. Equally important, we cannot set unreasonable levels of regulations, restrictions, bureaucracy, incumbencies so that industry look at Alberta and say "they are a closed shop". We would not be doing our children a favour to tell them that we have looked after the environment so well that Alberta is a good place to own a cottage but live somewhere else to make a living. I feel that we already have more than enough government departments and regulations.

At present there is a Minister's Council on Local Development going around the province attempting to determine what can be done for rural Alberta. The declining population in rural Alberta is playing out a bleak scenario - many of our communities and the people within them have lost their life savings and future. Overly zealous rules result in industry looking at other avenues. Remember: employment is directly proportional to population increase or decrease. If people are leaving your community it normally means there are no jobs available locally.

.../2

The Local Development Initiative is trying to find ways to encourage business to move to rural Alberta. We feel that there is room for both industry and clean air. The present regulation must be enforced but must be fair to the industry also.

My estimation is that approximately 60 percent of our population in the Crowsnest Pass is employed in the energy sector so you can see the concern of our board with this subject.

Thank you for this opportunity to address you this evening. I trust that the recommendations which result from this process will have an even balance.

Sincerely,

C.K. (Cliff) Reiling
Crowsnest Pass Economic
Development Coordinator

CR/ck

MUNICIPALITY OF CROWSNEST PASS

P.O. BOX 370
COLEMAN, ALBERTA
T0K 0M0
PHONE 1-403-562-8836

December 13, 1990

SUBMISSION TO THE CLEAN AIR STRATEGY FOR ALBERTA

The Municipality of Crowsnest Pass appreciates the opportunity to present some of our concerns with respect to development of a clean air strategy. Indeed, air quality is a matter of great concern to all of us, and we recognize the traditional aphorism that "we foul our nests at our own peril".

Most of us are aware of concerns regarding the effects of burning fossil fuels and of deforestation. Acid rain and the death of over two thousand (2,000) lakes in the east is a sin. The loss of great areas of rain forest such as is occurring presently in Brazil is of great concern. We wonder about the hole in the ozone layer but at the same time note that such holes have probably occurred before and that the present hole now appears to be closing. We also wonder about global warming although again one must recognize that significant global temperature variations have occurred in the past.

In examining the effects of burning fossil fuels we must not overlook the human needs being met by the use of these fuels. Furthermore, we can not advocate the position that all use of such fuels is bad and that our people should consequently be asked to no longer use these fuels and to "freeze in the dark". On the contrary we must be mindful of legitimate human needs and consider all the economics of any proposals regarding energy use in our society. To be successful any proposed initiatives must not only be viable but must also be perceived by the general public to be reasonable and viable.

Beyond expressing our concerns and perhaps refusing to buy the products of the deforestation there is probably little we can do about the destruction of the rain forests in Brazil. There is however something that we can do about sulfur dioxide emissions and acid rain in the eastern part of our own country and that is to continually remind those who burn coal in the east that high quality, low sulfur western coal is available to meet their legitimate needs and that the use of western coal would not only reduce their emissions, acid rain and death of their lakes but would also keep Canadians employed, aid our economy, and reduce costs of unemployment rather than exporting jobs to the United States from whom we are importing high sulfur coal. The use of western coal can be further augmented by purification and size processing and costs to the consumer could also be reduced by using alternate forms of transportation such as utilizing pipelines.

Recovery of sulfur in gas processing is much more efficient in recent years and unquestionably close attention should be maintained to ensuring that sulfur dioxide emissions are minimized in Alberta as much as possible. The utilization of effective scrubbers and condensers should be designed where ever appropriate and to any facility processing or utilizing fossil fuels.

Some emissions are proportional to population and become a much greater problem with population concentration such as we see in our major cities, the smog situation in Calgary perhaps being the most notable. Many factors enter into this population concentration not the least of which are economic factors including taxation policies and levels and other cost considerations which lead employers who could well locate elsewhere to choose to operate their business in the major cities. These taxation policies could well be changed leading to an economically level playing field across the province and encourage decentralization of business, industry, and population and consequent decrease in concentration of emissions and smog.

We could also utilize biological systems to reduce carbon dioxide concentrations for example, by the active promotion of large scale tree planting.

With respect to trees, logging, and the Alberta Forest Service it should be noted that over the past three (3) decades Alberta has had the best track record with respect to silviculture of any jurisdiction in North America. We continue to support the position that timber is a renewable resource which should be utilized by man and should be properly managed. This not only implies planting but also implies that trees should be harvested when mature and not be allowed to fall prey to disease, to rot and to burn. The recent disastrous experience in Yellowstone National Park in the United States encouraged by those who advocate natural rather than planned reforestation serves as a shining example of what not to do.

We have heard arguments over the past few years that nuclear power is clean, cheaper and the preferred source of energy for the future. We would take issue with the claim that nuclear power is cheaper as true cost accounting should include the cost of the massive public subsidy of the construction of nuclear plants, the hidden costs of waste disposal, as well as the increasingly apparent high costs associated with maintenance, leaks, and contamination. In reality looking at total costs as well as health hazards, nuclear power is not cheaper and is not cleaner.

Public awareness and recession economics may well dictate a transition to more of a conserver society. At the same time the public should be provided with balanced information regarding issues such as use of energy and further the public must be allowed reasonable individual choice. Indeed without public support no initiative will succeed no matter how logical it may seem in the mind of an individual proponent.

Only if they are perceived to be reasonable by the general public can any actions taken by consumers and producers to reduce emissions be practical and achievable. We hope and trust that some of the suggestions we have made with respect to improving air quality will be incorporated as part of Alberta's ultimate clean air strategy.

OFFICE OF THE MANAGER

TOWN OF PINCHER CREEK

BOX 159, PINCHER CREEK, ALBERTA T0K 1W0

FAX: 627-4784 PHONE 627-3156

WRITTEN PRESENTATION: CLEAN AIR STRATEGY FOR ALBERTA

We appreciate the opportunity to address this forum and encourage the government to continue holding forums like this to allow citizens to express their concerns.

The Town of Pincher Creek is concerned about the environment and environmental issues. Above all we wish to preserve the beautiful natural surroundings we have all around us. We support any legislation that will preserve and enhance our environment provided it does not have a detrimental effect on our current way of life and living standards. The concept of sustainable development is strongly supported by the Town of Pincher Creek. The main smoke-stack industry in the area, the Shell plant, has substantially reduced its emissions and continues to improve their performance in this regard. We commend and support them in their efforts.

It is our opinion that industries and individual companies should be environmentally responsible and sensitive to the concerns of both the local population and the population in general. Government policies and regulations that stress this responsibility by holding individuals as well as organizations accountable for their actions would be strongly supported by the people of Pincher Creek. Pincher Creek commends the government for the direction it is taking regarding environmental issues and we encourage it to continue to focus on environmental concerns.

The Town would encourage the further development of policies and regulations that provide more protection to the environment, address the specific concerns of citizens regarding local companies and industries, and punishes irresponsible organizations and indeed individuals. However, we would not endorse or support any policies or regulations that completely inhibit development or give organizations reasonable time to react to the changes in policies and regulations. As previously stated we strongly endorse the concept of sustainable development.

Office of the Mayor

December 14, 1990

Clean Air Strategy for Alberta
Bag 1, Mail Room
Main Floor, North Tower Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Dear Sir or Madam:

RE: CLEAN STRATEGY FOR ALBERTA

Council of The City of Red Deer, at its meeting held on Monday, December 10, 1990, unanimously passed the following motion with regard to the above-noted topic:

> "RESOLVED that Council of The City of Red Deer having considered reports re: Clean Air Strategy for Alberta hereby endorses the issues raised by the Parks Manager and that same be forwarded to the province for consideration in drafting a Clean Air Strategy for Alberta and as presented to Council December 10, 1990."

I am enclosing herewith a copy of the report from the Parks Manager which is referred to in the above-noted resolution. We trust that you will take into consideration the issues raised by the Parks Manager when drafting a "Clean Air Strategy for Alberta".

We thank you for the opportunity to provide comment on this important issue and should you require further information or clarification please do not hesitate to contact the undersigned. Trusting you will find this satisfactory.

Sincerely,

R. J. McGHEE
Mayor

/bd

Encl.

c.c. Director of Community Services
Parks Manager
Environmental Advisory Board
City Clerk

DATE: **November 20, 1990**

TO: **ENVIRONMENTAL ADVISORY BOARD**

FROM: **DON BATCHELOR**
Parks Manager

RE: **CLEAN AIR STRATEGY FOR ALBERTA**

Alberta Energy and Alberta Environment are launching a number of public open houses and public forums across the province. In addition, they will be inviting briefs from individuals, groups and other levels of government to obtain information on drafting a Clean Air Strategy for Alberta.

Attached is a letter from Mr. R. Mitchell, Coordinator, Clean Air Strategy for Alberta, to the City Commissioner requesting the City of Red Deer's participation in this process. I have also attached a series of articles and documents for the Board's review.

The primary purpose for the Province inviting public and municipal input is:

a) to identify and clarify the possible impact of energy related emissions on the environment (i.e. impact of fossil fuels on global warming, acid deposition and smog);

b) to outline practical and achievable actions that can be undertaken by consumers and producers to reduce emissions.

With the attached documents as background information, I have outlined below some concerns or issues which should be forwarded to City Council and then to the Province for their consideration in drafting the Clean Air Strategy. A public open house session will also be conducted in Red Deer December 6, 1990 at 12:00 noon, and 7:00 p.m. respectively, at the Capri Hotel (see attached).

<u>CONCERNS - CLEAN AIR STRATEGY</u>

1. Identifying the impact of energy related emissions from fossil fuels on the environment is best dealt with by the experts. The effects of CO_2, SO_x, NO_x, VOC_s, and CH_4 emissions vary significantly geographically across the province

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and an extensive monitoring/recording system should be set up to collect data. This data would clearly identify problem areas, potential sources of the problem and, therefore, solutions and achievable actions can be considered.

2. The production of electricity in the province is largely generated from coal powered electrical plants. The consumption of coal emits significant amounts of gaseous emissions; consideration must be given to initiatives in generating power by some other means (i.e. hydro, wind, etc.) across the province. The Electric Utility Planning Council has submitted a brief that attempts to address the consequences of coal produced electricity and has offered some alternatives.

3. The issue of public transportation can have a significant effect on air quality. Incentives must be put in place that promote, encourage and make mass transit systems desirable, accessible and affordable to the public.

4. Programs that are directed to the Efficient Energy Management of Facilities/Industries which presently exist through Alberta Government Departments, utility companies, private companies and municipalities should be applauded. These efforts are but the beginning of a long process of informing, educating, training and encouraging the public and industry to undertake energy-efficient practices at home and in the work place. The Energy Audit Buses, for example, is a program that needs to be expanded such that homeowners, apartment building managers, commercial and industrial developers, and different government officials can access this tool of measuring energy consumption in buildings and operations. From these consumption statistics one can identify means of increasing energy effectiveness. To be effective, an extensive public awareness program should be launched to inform everyone of the procedures and practices that can lead to improved energy use (see "Energy Efficiency - Clean Air Strategy of Alberta" brochure). As illustrated by the Edmonton Public School Board, the initial investment of modifying operational procedures on their buildings has resulted in a $10.2 million saving over 7 years in fuel savings and has contributed significantly to environmental sustainability.

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5. All educational institutions should contain, as part of their curriculums, the principles of reduce, re-use and recycle. Schools have the captive audience to instill environmental management practices as part of every day life.

6. Since gaseous emissions, in particular carbon dioxide, can be filtered and processed by trees, the concern for clean air can perhaps be best illustrated to the public through emphasizing the benefits of trees to our urban environment. Trees are something everyone can identify with, can plant, can enjoy the immediate benefits, and could be taught the long-term environmental benefits.

   Not only do trees provide colour, landscape enhancement, shade, aesthetics, screening, etc., they most importantly produce oxygen, while consuming carbon dioxide. In addition, this process cools the earth by evaporating water into the air. Provincial and municipal initiatives that encourage and support tree planting programs should be promoted and assistance should be considered in the form of expertise, funding, plant material, etc.

   A tree planted in an urban area can be 15 times more effective than a forest tree in reducing the build up of carbon dioxide in the atmosphere. Urban trees also filter the air of dust and other particulars providing a cleaner air. Programs such as Arbor Day and Environment Week can be expanded upon to encourage individuals to plant trees in their yards, developers to incorporate tree planting in commercial and industrial developments, and all levels of government to plant trees within urban areas. Assistance programs, such as tree planting grants from the Province, may be the needed impetuous to launch a beneficial public education program on the "Benefits of Trees" and a major thrust towards tree planting initiatives.

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RECOMMENDATION:

That the Environmental Advisory Board support and recommend to City Council that the concerns outlined in the Parks Manager's Report be forwarded to the Province to be considered in the drafting of a Clean Air Strategy for Alberta.

DON BATCHELOR

DB/ad

Att.

Commissioners' Comments

We concur with the recommendations of the Administration and Environmental Advisory Board.

"R.J. MCGHEE"
Mayor

"M.C. DAY"
City Commissioner

LEGISLATIVE ASSEMBLY
ALBERTA

GRANT MITCHELL, M.L.A.
EDMONTON MEADOWLARK

October 25, 1990

Dear Reader:

I am sending you some information on environmental issues that have been dealt with by the Liberal Caucus during the past session of the Legislature. This provides an indication of subjects that we consider important and of environmental policy improvements for which we are striving.

The list is not exhaustive. We continue to develop policy on existing issues and new issues are always arising. If there is any specific environmental matter that concerns you, or if you would like more information about the Liberal position on any topic, please let me know.

May I also draw your attention to the form at the end of the attached environmental report. It seeks information concerning your interest in receiving our policy material.

Yours truly,

Grant Mitchell, MLA
Liberal Environment Critic

GM/mg/kb
Enclosures

LEGISLATIVE OFFICE:
ROOM 204
LEGISLATURE ANNEX
EDMONTON, ALBERTA T5K 1E4
TELEPHONE: (403) 427-2292
FAX (403) 427-3697

CONSTITUENCY OFFICE:
6721 - 177 STREET
EDMONTON, ALBERTA T5T 4K3
TELEPHONE (403) 444-4757

RECYCLED BOND

LIBERAL'S LEGISLATIVE AGENDA FOR THE ENVIRONMENT

Spring session, 1990

The Liberal's Legislative agenda was embodied in two areas of legislative initiative:
1. Bills and Motions
2. Points made in Question Period and Media Releases

1. BILLS AND MOTIONS

The environmental issues on which the Liberal Caucus introduced Bills or Motions can be divided into three categories, concerning:
1.1 Improvements to the process by which environmental policy is developed;
1.2 Environmental issues of specific relevance to Alberta;
1.3 Environmental issues of global importance.

1.1 Improvements to the Process by which Environmental Policy is Developed

There are many specific environmental issues in Alberta which received the attention of the Liberal Caucus, but environmental matters cannot be dealt with simply on an ad hoc basis. We need legislated processes to protect the environment, to allow for public input into legislation, for an ongoing public review of environmental issues and for recourse by the public when their values and judgement differ from those of the government. Bills 205, 218, 238, 251 and 272 address these needs.

Bill 272 Environmental Assessment Act. This Bill would establish a board of impartial experts to review all significant industrial development projects and other initiatives, that might have serious environmental impacts. It would be able to review forest management agreements and pulp mills, including those already built. It would, among other things, provide for open public hearings and for the funding of public intervenors.

Bill 238 Environmental Ombudsman Act. The Environmental Ombudsman would give Alberta an environmental "watchdog", able to intervene on behalf of the public, where citizens feel that government action or inaction has been inappropriate. At present, the only recourse is for a citizen to seek the help of the Courts, which is both costly and cumbersome.

Bill 205 Freedom of Information and Protection of Personal Privacy Act would require the provincial and municipal governments to release information and documents of relevance to the public interest. This would enable public access to information concerning the full range of government activities, including environmental policy.

Bill 251 Forest Industry Development Act would end the conflict of interest that currently exists within the Department of Forestry, Lands and Wildlife since that department has responsibility both for protecting features of the environment and, on the other hand, for promoting forest industry development. This Bill would remove the latter responsibility to the Department of Economic Development and Trade, enabling the Department of Forestry, Lands and Wildlife to concentrate on the task of conservation.

Bill 218 Agricultural Resources Conservation Board Act. Alberta has only a limited amount of good quality agricultural land. Yet, each year, we lose between 1500 and 2000 acres of prime farmland to non-agricultural uses. The Environment Council of Alberta proposed the idea of an Agricultural Resources Conservation Board in 1984, but the government has taken no action. This Liberal Bill would establish such a Board to

minimize the loss of farmland and to stimulate agricultural practices that will protect and recover agricultural land.

1.2 Environmental Issues of Specific Relevance to Alberta

Motion 261 Under a Liberal government all new pulp mills and forest management agreements would be subjected to a full environmental review, as laid down in Bill 272, described above. In an attempt to deal with the current situation, Liberal Environment Critic Grant Mitchell presented a motion calling upon the government to place a moratorium on all pulp mill developments until every one of the projects not yet licensed has undergone a proper public environmental assessment process. The motion requested the government to take into account available zero-effluent technology and to include an assessment of each forest management agreement.

Bill 202 Recycling Act was the Liberal priority Bill this session and was thus introduced by Liberal Leader Laurence Decore. The Bill is designed to promote waste reduction, establish a province-wide recycling program and stimulate recycling industries and markets for recycled materials.

Bill 210 Ecological Reserves and Heritage Rivers Act. Alberta has only 12 ecological reserves (including the recently announced Rumsey Reserve), most of which are of inadequate size. Eight distinctive types of natural area in Alberta are still unprotected. This Bill would require the government to establish ecological reserves to reflect each of the 17 types of ecological region in the province. The reserves would be created large enough to preserve the natural flora and fauna which they represent. Under this Bill, Alberta would also be required to participate in the Canadian Heritage Rivers System programme. The Liberal Caucus feels that it is essential that we preserve those unique parts of our environment that, once destroyed, can never be recreated. A copy of remarks made by Grant Mitchell at the second reading of this Bill is enclosed, for further information.

Bill 212 Alberta Youth Conservation Corps Act would establish a voluntary youth conservation corps to undertake conservation projects in Alberta. Liberal Education Critic Yolande Gagnon introduced this Bill not only to help preserve our environment but because such a Corps would have an important educational aspect, providing a greater understanding of environmental issues.

Bill 224 Water Transfer Control Act. Water is becoming an increasingly scarce resource, not only in southern Alberta, but elsewhere. This Bill, which was introduced by Liberal Agriculture Critic Nick Taylor, is designed to ensure a secure water supply for Alberta by prohibiting the transfer of water out of a provincial drainage basin without the approval of the Minister of the Environment.

1.3 Environmental Issues of Global Importance

Motion 225. Although there is still some controversy about the potential for global warming, due to increased carbon dioxide and other "greenhouse gases" in the atmosphere, the consequences of delay could be so serious that action is required now. Grant Mitchell presented a motion calling on the government to reduce Alberta's contribution to global warming by initiating economically responsible measures that will reduce, by the year 2005, the discharge of carbon dioxide to 20% below the levels in 1988. He also urged the government to investigate what measures are necessary to

mitigate the anticipated effects of global warming.

Bill 261 An Act to Phase Out the Use of Chlorofluorocarbons. At present, when we discard a refrigerator or a car with air conditioning, chlorofluorocarbons (CFC's) escape into the atmosphere, damaging the ozone layer and contributing to global warming. Facilities to collect and recycle or destroy these CFC's would be established under this Bill. It would also supplement federal legislation in setting time limits for phasing out the use of CFC's and other gases which damage the ozone layer.

2. POINTS MADE IN QUESTION PERIOD AND MEDIA RELEASES

During the spring session of the Legislative Assembly, the Liberal Caucus raised a wide range of environmental issues, through question period, other debating opportunities and media releases. These included:

2.1 Pulp Mill and Forestry Developments

- Disclosure of information on dioxin levels in fish taken from the Wapiti River.

- Request that government reassess new information on dioxins and furans, which indicate that human health effects may be much greater than previously thought.

- Failure of the government to issue a certificate of variance and make a public announcement when discharges from the Proctor and Gamble Pulp Mill at Grand Prairie exceeded the license limits in 1988.

- Government tardiness in analysing samples of fly ash taken near the Millar Western Pulp Mill in Whitecourt and the potential health effects of contaminants in the flyash.

- Failure of the government to accept and act upon the findings of the Alberta-Pacific Pulp Mill Review Board; the waste of public funds in engaging the Finnish firm Jaakko Poyry Consulting Inc., to carry out a survey of the scientific data submitted to the Review Board; the lack of credibility of this firm, which describes itself as "serving forest-based industries", to carry out an independent review.

- Request for baseline water and wildlife studies as required by the Alberta Pacific Review Board and for an independent review of the new Alberta-Pacific proposal.

- Request that the government require the Alberta-Pacific Pulp Mill to be chlorine-free, eliminating even chlorine dioxide in the pulping process.

- Failure of the government to allow public input into the license to operate for the Daishowa pulp mill at Peace River, even though such input was allowed for new licenses for the Proctor and Gamble mill and a similar process was expected by Daishowa.

- Criticism of government forest management policy, as seen in the Naylor Hills area, where deforestation has disrupted the local drainage pattern and prevented regrowth of the forest cover.

- Request for an Environmental Impact Assessment of the wood processing plant to

be operated by Sunpine Forest Products Ltd. of Rocky Mountain House, and of the forest management area to be logged by the company.

- The government "give-away" of Alberta's timber resource, due to the fact that the stumpage fees for timber quotas have not been raised since 1975. This is costing the province up to $20 million a year in lost revenue.

- Concern at the low minimum bid price for timber quotas and the need for the government to take steps to ensure that there is not collusion between companies to reduce competition and thereby lower prices for timber quotas.

- Criticism of the government's new plans for public involvement in forest management planning, as the public will only be involved after the forest management agreement has been signed, and the company itself is responsible for liaison with the public. Need for assurances that native groups will be involved in each step of the public input process.

- Demand that logging be ended in Wood Buffalo National Park.

2.2 Natural Resources Conservation Board Bill - Government Bill

- Shortcomings of the proposed government Bill 52, Natural Resources Conservation Board Bill, a piece of legislation which does not even fall under the jurisdiction of the Minister of the Environment. The Liberal Caucus has serious reservations about this Bill, due to the potential for government manipulation of the Board. The Board does not have adequate powers and in many cases the decision to conduct a review is left to the discretion of the the government. There is reason for further concern that no reviews of Forest Management Agreements will be conducted.

2.3 Global Warming

- The Minister of Energy's failure to endorse the international resolution calling for a 20% reduction in carbon dioxide emissions by the year 2005 and the need to provide leadership in addressing the issue of global warming.

- Request that the Alberta government establish a forum on global warming, similar to that organized by the federal government for decision-makers in Ottawa.

- The potential effect of global warming on agriculture in Alberta, as indicated by an Environment Canada publication "The Effects of Climate and Climate Change on the Economy of Alberta" and a report by the Alberta Research Council on "Adapting to Climatic Change in Alberta".

2.4 Conservation

- Failure of the government to commit itself to a conservation strategy for Alberta.

- Request that the government endorse the World Wildlife Fund and Canadian Parks and Wilderness Society Endangered Spaces Campaign.

- Request for an Environmental Impact Assessment of the proposed developments in the Bow Corridor.

- The Premier's repeated undermining of the power of the Minister of the Environment and the general lack of confidence in the Minister of Environment's ability to deliver on his promises concerning environmental protection, conservation and waste reduction and recycling.

2.5 Waste Management and Recycling

- Request for government to introduce a recycling policy, including a government procurement policy, e.g. for recycled paper.

- The excessive cost of the Alberta Special Waste Management Plant at Swan Hills, which took the entire increase in the Environment Budget in 1990, especially when compared with the lack of funding for recycling.

- Government failure to continue financial support of the Ryley composting project, without any advance warning, even though this project of international fame has a 95% participation rate and reduces the solid waste stream in Ryley by 35 - 40%.

- The need for a comprehensive government plan for handling biomedical waste, some of which is at present sent to landfill sites.

2.6 Water Issues

- Concern about compensation for the water rights lost by the Peigan Indians, due to the construction of the Oldman River Dam.

- Lack of an opportunity for farmers and farm organizations to put forward their opinions before the government introduced new regulations allowing oil companies to take up to one half the potable or usable water from any water reservoir to enhance oil and gas recovery. Government failure to ensure that aquifers are not polluted by chemicals.

- Government policy that allows over 300 towns in Alberta to flush their sewage lagoons and storm water once or twice a year into creeks and streams, with particular reference to the Wabash Creek and the Olds Creek.

- The involvement of the Minister of the Environment in discussions about the construction of a road through Lily Lake.

2.7 Other Issues on which the Liberals have taken Public Positions

- Inadequate representation of environmental interests in the Round Table on the Environment and Economy.

- Request for public hearings into game ranching before proceeding with government Bill 31, Livestock Industry Diversification Act. As the government failed to agree to such hearings on this controversial issue, the Liberal Caucus decided to vote against the Bill at third reading.

The above list indicates the breath of environmental concerns expressed by the Liberal Caucus. Should you require a copy of any specific piece of legislation, do not hesitate to contact Grant Mitchell at the Legislature, telephone 427-2292.

A FINAL NOTE

The Liberal Caucus continues to work for a clean environment and to ensure that all new developments are environmentally acceptable and we hope you will be interested in receiving future editions of the Liberal's Legislative Agenda for the Environment. However, we do not want to waste paper by mailing to those people who do not want to receive it.

If you wish your name to be removed from our mailing list, please let us know, either by telephone (427-2292) or by completing the appropriate line on the slip below.

Please complete the slip below if you wish to receive more information about the Alberta Liberal Caucus. We will be happy to put your name on our mailing list for either the environmental media releases or for our weekly mailout of all Liberal Opposition media releases.

.....

Name:.....

Address:.....

Town: .....Postal Code: .....

Telephone (home) ..... (work).....

Please tick as appropriate:

.... I would like my name removed from the Liberal Opposition Environmental Mailing List.

.... I wish to receive media releases on environmental subjects.

.... I wish to receive the weekly package of Liberal Opposition media releases.

Please return slip to:

Grant Mitchell, MLA, Liberal Opposition, #204, Legislature Annex, Edmonton, T5K 1E4.

Province of Alberta

The 22nd Legislature
Second Session

Remarks on Bill 210
Ecological Reserves and Heritage Rivers Act

Grant Mitchell, MLA
Edmonton-Meadowlark

Excerpted from *Alberta Hansard*
May 31, 1990

MR. MITCHELL: Mr. Speaker, it's with a great deal of anticipation and pleasure that I present this Bill. It is with anticipation and pleasure because I believe that this Bill is extremely important to an enlightened environmental policy on behalf of the government of Alberta. Certainly there are, in one sense, what appear to be issues of a higher public profile than ecological reserves and heritage rivers. There are issues of a more pressing and focused nature perhaps. But there is no issue more important than the issue which Bill 210, the Ecological Reserves and Heritage Rivers Act, addresses in the broad spectrum of environmental issues.

Mr. Speaker, this Bill will serve to amend the current Wilderness Areas, Ecological Reserves and Natural Areas Act in three ways: first, to require that at least 12 percent of the province be designated by the year 2000 to be protected in its natural state; second, to designate at least one ecological reserve of adequate size in each of the 17 natural regions of the province by no later than the year 2000; and third, to require that Alberta join the Canadian Heritage Rivers System program and designate heritage river areas along rivers of special ecological and/or historic and/or cultural importance.

I was impressed vividly several weeks ago, Mr. Speaker, when speaking to a friend of mine about the significance of ecological reserves and heritage rivers. This friend said, "You know, Grant, we're not talking about ecological reserves; in fact, what we are talking about are ecological museums." If one considers the concept of museum, you begin to get a sense of how important this Bill and the program that it represents are. Museums are a place where we put things that we want to preserve because they have disappeared: artifacts of previous ways of living, artifacts of previous ways of life. Well, Mr. Speaker, it is becoming painfully apparent, not only in the world at large and in general but also in this province, that there are kinds of biological ecosystem spaces in this province which are disappearing, which in fact have disappeared, and there are more that will disappear or will be endangered if we do not move in a responsible and reasonable fashion to set them aside and to protect them in their pristine, unencumbered, untouched, natural condition.

I'll give you an example of several such areas. The Rumsey area. Less than 5 percent of the original aspen parkland in the world remains. The small block of original aspen parkland found in the Rumsey area, about a 180 square kilometre area, is the largest remnant of this kind of ecosystem, this kind of ecological area, in the world.

Milk River, Lost River. This is, Mr. Speaker, a biologically diverse area which includes several plants and animals found nowhere else in Canada. A tiny ecological reserve has been set aside, 11 square kilometres, but this particular area, the Lost River area, has not been set aside in any kind of reserve area.

Mr. Speaker, what we are talking about is a program, if we are not careful in other ways in how we encroach upon wildland areas, that ultimately and to some extent today in fact is an ecological museum program. When I think about the risk of this government not proceeding quickly enough – in fact, reacting very cynically through the statements of their minister – to the ecological reserve program, to the endangered spaces program, I can draw a very vivid analogy. For the Minister of Recreation and Parks to say that ecological reserves are a huge land grab, for this minister to watch while certain ecological areas of this province literally become extinct to this province, extinct in some cases to the world, would be tantamount to this government finding those dinosaur bones in the Tyrrell area and throwing them away.

Isn't it ironic, Mr. Speaker, that something that is millions of years dead we place an intrinsic value on? Fortunately, we do, and this government is to be congratulated for having done that. We would not contemplate for a minute throwing those natural resources, those profound historic resources away. At the same time, this minister will sit paralysed while very, very sensitive, very rare ecological areas are being frittered away because we continue, in our development initiatives, to encroach upon them and to kill them. Mr. Speaker, we are talking about ecological museums. We are talking about a travesty and a tragedy if this government continues the practice of the delays that we have seen.

It's very interesting to note that the Minister of Recreation and Parks wrote an open letter to the Alberta chapter of the Canadian Parks and Wilderness Society, tabled in May of 1990 in the Legislature. He responds to their article, and it says in here:

> Your article states that it is incorrect to assume that "there's no rush to ensure protection for Alberta's wildlands."

The minister goes on to say:

> Well, there is a need for ongoing work on this kind of protection, but rushing in without good data, good plans and good choices of sites, can be equally dangerous, particularly for the sites involved and for our long-range objectives.

This, Mr. Speaker, from a minister of a government which in 18 months set aside 200,000 square kilometres of northern Alberta in forestry management agreements. If that isn't rushing, I don't know what rushing is. They have had no qualms about rushing in to set aside huge tracts of northern Alberta at the disposal of companies to move in and make land use choices without adequate study, saying, "We'll do ongoing study." And then this minister has the gall to turn around and say, "Well, we can't rush in and set aside 17 ecological reserves right away," when they are in the order of maybe 28 square kilometres – in fact, some of them are less than 28 square kilometres – where they in no way approach the massive size of the forestry management areas that have been set aside in 18 months. Why is it not the case that we could go in and set aside all the ecological reserves right now, set aside more than what might ultimately become the prescribed and proper size, and do ongoing studies to ensure that ultimately we do make the right decision? Why is it that he doesn't set them aside now and then worry about making sure that his concerns are met, if that's absolutely necessary, later? Certainly the precedent has been set.

Mr. Speaker, we need ecological museums, and we need action. We do not need a minister who stands up and calls ecological reserves a massive land grab. We do not need a government who is perfectly prepared to set aside 200,000 square kilometres for development and can't see their way clear to setting aside 200 or 300 or 400 square kilometres for future generations not only to appreciate but literally for the survival and success of our species and of all species on the face of this earth.

Mr. Speaker, this Bill is in support of, among other things, the endangered spaces program today being promoted on an international level by the World Wildlife Fund and by the Canadian Parks and Wilderness Society. I know that Albertans, and this government in particular, look out and say that Alberta has miles and miles of untracked lands. Well, Mr. Speaker, those lands have been encroached upon in many different ways. Even ecological reserves that have been set aside to this point have been encroached upon, have not been managed properly by this government, and very, very quickly there will be very few wildlands left even in a province like Alberta.

Mr. Speaker, the advantages of an aggressive ecological areas and heritage rivers program are many, and I would like to list several. First of all, it is critical to gene pool conservation. If we are to avoid the extinction of rare species of animals and plants, then we must set aside areas, ecosystems, which sustain the lives of those animals and plants. There is a very critical relationship between endangered spaces and endangered species. For the longest time we talked about the extinction of species and tried to focus on the animal itself with our concern. It has now come to scientific conclusion that of course animal species are endangered because their spaces are endangered. We require ecological areas, wilderness areas, and heritage rivers to be set aside to preserve a gene pool; to allow over-harvested species to return to normal levels; to avoid the extinction of certain rare species; to maintain the diversity of species necessary for the health of animals, for the health of our crops, and for the health of humans. This program is essential for the preservation of habitat, to preserve ecological diversity, and to protect ecosystems. It also underlines the recognition of the need for plant and animal species to survive, regardless of what value or lack of value we may place on any given animal or species.

Mr. Speaker, it is also the case that contrary to the conventional wisdom held by this government, these are not non-economic programs. These, in fact, are programs which have an essential economic value and which may contribute very significantly in the short run and in the long run to the strength of Alberta's economy. There is a scientific research value. Mr. Speaker, it is a service that we can provide the world if we can set aside areas that attract scientists intent upon research into species of plants and animals.

It is also true that ecological reserves and heritage rivers are critical and very important to the future of tourism in Alberta. I think we cannot emphasize enough the significance of our wildlands and our wildland tourist opportunities not only today but especially as they will grow in the future in a world that is increasingly seeing wildland spaces disappear. Imagine people living in the crowded European context wanting to come to a place like Alberta where there are still untapped, pristine, unfettered natural areas.

It is also very important, Mr. Speaker, that ecological areas and heritage rives be set aside for their contribution to resource protection and their contribution to resource management.

And a final point, a final value to this kind of program, Mr. Speaker, is one that I believe is underestimated and hasn't been addressed very broadly, and that is the cultural heritage significance of ecological reserves, of certain ecosystems, to Albertans' way of life. We have a certain character, have a certain strength, have a certain value in our lives because of the physical surroundings within which we live. We view the world differently than somebody who lives elsewhere in the world without mountains. We view the world differently than somebody who lives elsewhere in the world without certain kinds of prairie grasslands. We view the world differently than people who live in different physical surroundings. I believe that our roots, our traditions, our sense of purpose and place in our physical surroundings and in our society and, therefore, our culture are inextricably tied to the preservation of the natural surroundings within which we find ourselves.

Mr. Speaker, we are not asking for very much in this program. We are not asking to set aside huge portions of this province. We are not asking to set aside portions of this province that in any way, shape, or form even approach the size of areas that have been set aside, for example, for forestry management areas. What we are asking in this Bill is for a very reasonable amount of this province to be set aside, not to be put out of commission – not put out of reach of Albertans, not put out of commission for economic reasons, which are so important for this government – but, in fact, to be set aside for all kinds of valuable reasons for Albertans now and in the future.

The circumstances in Alberta currently with respect to ecological reserves and the setting aside of natural areas, Mr. Speaker, are these. Approximately 9.4 percent of our province is protected in some way, although I use that term "protected" very loosely, because the consistency of management of "protected areas" is very questionable in this province. Of that, only 8.5 percent is reserved with no logging, mining, or sport hunting, and almost 90 percent of what is set aside is set aside not in provincial reserves but in fact in national parks. The provincial commitment to reserve lands of one form or another, Mr. Speaker, is 1.2 percent of the area of this province, and of that, only .03 percent is set aside in any kind of ecological reserve at all. In fact today, Mr. Speaker, of the 17 distinct ecological regions in this province, only 11 have had designated ecological reserves set aside by this government, and any kind of analysis tells us that only three of those are large enough to sustain the species, both plant and animal species, within the areas that have been set aside.

Mr. Speaker, that is a dismal track record for this government, which commenced this program in the early 1980s. It is such a simple thing to do: to set aside 17 ecological reserves, to set aside 17 that are of sufficient size to provide for the sustainability of those kinds of ecosystems, the ecosystems that are reflected in each one of those reserves. This will not encroach upon economic development. It will not diminish the value of that land to Albertans. It will enhance and protect the value of that land and those areas and those rivers to Albertans. It is so obvious, it is so logical that this should be done, Mr. Speaker, that it is simply difficult to understand, no matter how hard one tries to analyze it, why this government seems unable and unwilling to do it.

We have no heritage rivers designated despite the fact that the Minister of the Environment, the predecessor to this current Minister of the Environment, signed a document, signed a national accord saying that we are going to be a member of the Canadian Heritage Rivers System program. We have not designated one such river. And this isn't even a complete set-aside program. This is a program that designates rivers of recreational consequence, so we can set aside some areas for recreation.

You know, Mr. Speaker, I can remember an interesting – certainly to me it was very interesting – occurrence. I was driving to the Legislature along River Road some time ago, and for some reason I remembered a day that I spent with my father 31 years ago swimming in the Ottawa River. That was a wonderful day; it was a wonderful time. I will remember it always. It was warm, the water was clear and clean, and the bottom of that river was so sandy. It was a wonderful experience for me to have, and it struck me: I would no sooner take my sons into that river today than become a Conservative. The fact is, Mr. Speaker, that you couldn't go into that river at Ottawa any longer. That was a beautiful river that has been ruined by industrial development, by unfettered and inappropriate industrial development techniques. I thought: isn't that sad? And then it dawned on me, as I drove by the North Saskatchewan River, that I wouldn't take my kids to swim in this river either. It was so far out of the realm of my consciousness

that I hadn't even ever thought of the possibility of taking my kids to swim in that river.

Well, Mr. Speaker, before we know it, there won't be a river in this province that we can take our children to swim in, not one river. If we would set our minds to it in this government, in this Legislature, if we would set an objective that said, "That is a travesty; we have the resources and we have the capability to set aside rivers and keep them clean, and this Bill embraces that ability and those resources," it would be an easy thing, easily done. It would be a gift that we could give to our children, a gift that I think would lend unparalleled value and richness to their lives.

The great irony in all of this, Mr. Speaker, is that there is profound public support for the setting aside of natural areas. If ever you needed to have a vivid example of that support, you just had to go to the Canadian Parks and Wilderness Society rally at the Jubilee Auditorium a number of weeks ago in Edmonton. There were upwards of 2,000 people in the Jubilee Auditorium who came to a rally that kicked off or at least elevated people's awareness of the endangered spaces program, the program which is supported by this Bill. People have a profound desire to preserve our natural heritage in this province, a profound visceral desire to do that, and it is evidenced in polls.

A poll taken in 1987 for Environment Canada prepared by the federal/provincial task force for the 1987 national survey on the importance of wildlife to Canadians says this: 87 percent of Albertans are in favour of maintaining abundant wildlife, saying that that is important or very important; 89 percent of Albertans said that preserving endangered species is important or very important; 86 percent expressed great or some interest in participating in one or more nonconsumptive wildlife related activities – observing, photographing, feeding wildlife; 28 percent expressed some or great interest in participating in a consumptive but renewable wildlife related activity, such as hunting and fishing; 31 percent indicated that they fish for recreation, on average, 13 and one-half days per year.

A recent study by the Angus Reid polling organization found that, of Albertans in the study, 66 percent wanted protected wilderness at least doubled. Sixty-one percent was the national average; 66 percent was the case in Alberta. One in five Albertans wanted to increase protected area by four times, and 95 percent of Albertans would pay $2 at a park entrance if the money were used for more wilderness parks and the conservation of land. Albertans are aware, and this government should be aware, of the economic significance of preserving these kinds of lands. I'll just state one important statistic out of this study: 1.7 million people, accounting for some duplication or people using wildlife resources more than once in a year, participated in wildlife related activities on an annual basis, collectively spending 102 million days of their time in wildlife areas in Alberta and spending $661 million on wildlife related activities.

Mr. Speaker, it is not the case that Albertans do not want to have a program of this nature. They desperately want to have a program of this nature, and they're not just saying it; they are showing it. To use the Conservative axiom "use it or lose it" and turn it on them, well, Albertans are using it, and this government's inactivity is going to ensure that they're going to lose it. So in this case it's use it and lose it. Well, Mr. Speaker, sometimes it is difficult to comprehend that when there could be so much public support for doing this program properly, this government simply can't tap into this kind of support. I should point out that the previous Minister of Recreation and Parks had a much greater and demonstrated commitment to this kind of program. In fact, he produced a state of the art report, and I only lament that he was unable to prevail upon his seatmate the current Minister of Recreation and Parks and his government to pursue that foundation and that framework document that he produced.

Mr. Speaker, I should point out that there are two particular technical features of this Bill that I would like to emphasize, because I think they underline how effective this Bill can be. First of all, we would like to see the guidelines and the decisions about ecological reserves – their size, the technical merits of buffer zones, and so on – established by a committee: not the committee that is currently defined under the Act but a committee that would be chaired by a member of the Environment Council of Alberta, thereby having objectivity, thereby utilizing the strength, the resourcefulness, the insight of that very, very worthwhile organization. In the Bill we outlined what kind of representation. There should be government representation, yes, from the relevant departments, and also there should be public representation, but it should be quasi-autonomous to the extent that the chairperson and the overseeing, the supervision of the setting up of this program, would be done by the Environment Council of Alberta.

Secondly, Mr. Speaker, we acknowledge that this kind of program, the Heritage Rivers System and the ecological reserves program, does directly confront land use controversies, does raise questions of competing interests over the use of certain pieces of land. So we have proposed a local round table system where ranchers and farmers, oil people, seismic companies, individual members of the public, hunters and so on can sit down and air their differences and come to conclusions. In fact, there is precedent even within this government's policy, where in one case such a round table was utilized to resolve a local land use planning issue with great success. People are reasonable in Alberta about the use of our land, and people are reasonable about the need to preserve for future generations the cultural and ecological heritage that is found in the 17 distinct ecological regions of this province and in the various rivers of this province.

You know, Mr. Speaker, yes, many environmental issues are extremely difficult because they confront competing interests so, so aggressively and with so much difficulty. But in this case there is a commonality of interest over setting aside adequate-sized reserves and setting aside rivers and parts of rivers within the Heritage Rivers System. It is not a contentious political issue; it is an issue that this government could embrace and could provide leadership in not only for Albertans, not only for Canadians but, literally, for the world. Mr. Speaker, I ask this government to undertake now to embrace the opportunity to provide that kind of leadership by supporting this Bill.

PRESENTATION ON

CLEAN AIR STRATEGY FOR ALBERTA

NOVEMBER 6, 1990

7:00 P.M.

BONNYVILLE AGRI-PLEX

FROM THE TOWN OF BONNYVILLE, ALBERTA

Mr. Chairman, members of the Advisory Group.
It is my pleasure As the Mayor to welcome you to the Town of Bonnyville.

Bonnyville has the distinction of being in the heart of Alberta's lake country, with 70% of all the lakes in N.E. Alberta, and also at the centre of the area's oil and gas industry.

For us the topic of "clean air" is a vital one. We are deeply concerned that we keep the balance between the natural resource industry, and the agriculture and tourism industries. All three are vital to the well being of this Region.

The lakes and rivers were the backbone of this Region's fur trading industry two hundred years ago, and today form the foundation of our tourism attractions. Besides fishing and boating pursuits, our lakes are drinking water sources for communities and farmers alike. We do not want to see them polluted by oil and gas plant emissions. To date we thankfully have no evidence of harm by gaseous emissions.

Conversely we are aware of the large deposits of heavy oil and gas in N.E. Alberta. Our local economy stands to gain considerably from their development. It is our desire therefore to see the development of the industry, but within "safe" emission guidelines. We do not advocate an extreme standard that would adversely inhibit production such as 99.99% clean emissions. However we do expect the plants to meet or exceed on a consistent basis their licensing commitment.

Currently we are quite satisfied with the performance of the oil companies and light industry in our area, and therefore have never had cause to pursue solutions.

Our submission is strictly one of supporting in principle the efforts to keep our air clean, and requesting a balanced view in the License to Operate standards that Alberta Environment sets. There has been too big a swing of the pendulum as Alberta has reacted to some very vocal specialist groups or small groups of citizens.

Simply put, Bonnyville needs the industry money to live with, and the clean air to enjoy that living, and we expect the regulations should reflect that.

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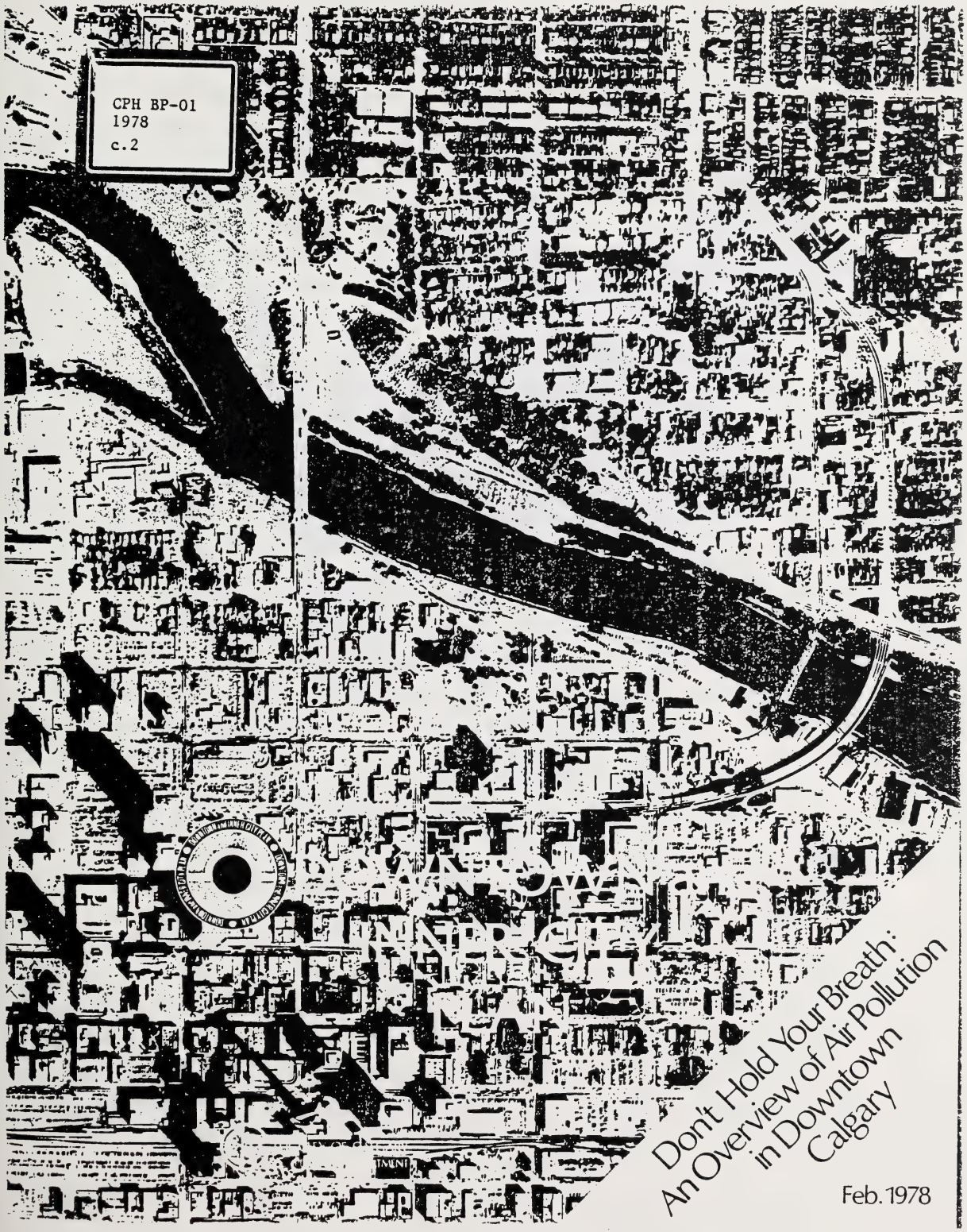
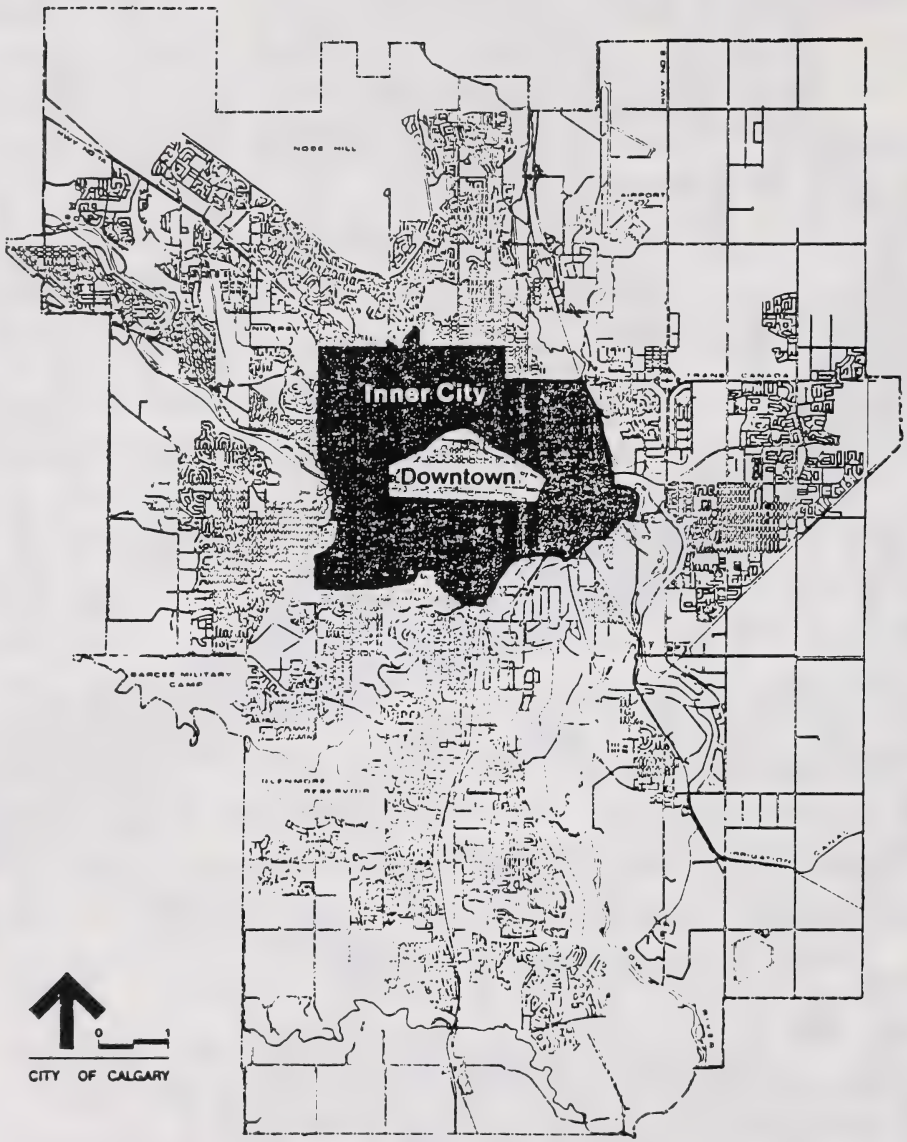


Don't Hold Your Breath: An Overview of Air Pollution in Downtown Calgary

Feb. 1978



Don't Hold Your Breath: An Overview of Air Pollution in Downtown Calgary

Feb. 1978

PURPOSE

This paper discusses the major sources, levels and implications of air pollution in downtown Calgary. For the most part, the text is taken directly from the sources referred to at the outset of each section. The report does not represent a rigorous research effort on the part of the Planning Department, rather, it is intended to present, first-hand, the observations and conclusions noted in the very few studies undertaken to date which may give substance to our understanding of air pollution levels in the downtown.

The paper begins with a brief description of meteorological considerations, including photochemical smog and temperature inversions, which affect the concentration and level of pollutants downtown. Air pollutant sources are then identified, as are the monitoring facilities and capabilities of Alberta Environment, the principle air quality monitoring agency in the city.

The paper then presents, in some detail, the results of two recent studies undertaken by research staff of the University of Calgary. The first study deals specifically with carbon monoxide (CO) levels downtown; the second, with the occurrence of carcinogenic (cancer inducing) hydrocarbons. Both studies focus on air quality within the pedestrian environment and on the impact of the automobile. Both studies, as well, conclude with thought provoking observations relative to the health effects of existing air pollution levels.

Air quality in downtown Calgary is then compared with that of several other North American cities and, from a somewhat different perspective, with the health effects of smoking.

Finally, several recommendations for planning guidelines are outlined and a number of critical questions are, again, put forward for consideration. Do existing pollutant levels create a "problem"? Should something be done to lessen pollutant concentrations and, more importantly, what and how much should be done and by whom?

SUMMARY

1. Downtown air pollutant concentrations do exceed provincial standards by a very substantial margin, and do so frequently.

2. Data are available indicating that the concentrations of pollutants at street-level are significantly (three or four times) greater than those measured by the Provincial Monitoring Apparatus - this is true too of higher pollutant levels inside downtown buildings than levels measured by the apparatus - the pedestrian environment is exposed to far greater levels of pollutants than is suggested by Alberta Environment data.

3. Motor vehicles accounted for 97.3% of all carbon monoxide levels in Calgary in 1973.

4. The concentration level of auto-induced pollutants depends in part on the number and speed of vehicles operating within the area and the extent to which physical and meteorlogical conditions act to hasten or retard the dispersion of pollutants.

5. The existence of massive, high buildings in the downtown tends to disrupt the natural flow of air from the northwest, thus hampering the dispersal of air pollutants in the area. Further, the deflection of normal air flow results in a variety of microclimatic conditions including wind tunnels and poorly ventilated "pockets" of high pollutant concentrations.

6. Normal pollutant levels are, in turn, worsened by the frequent occurrence of photochemical smog and low level temperature inversions.

7. Existing nitrogen dioxide levels constitute a potential health hazard.

8. In Smith's study, street levels of carbon monoxide downtown exceeded the Alberta standard for 23 of the 24 days tested.

9. For five of the fifteen days tested for December and January, levels of carbon monoxide in the downtown area reached concentrations that could pose a potential health problem to patients with heart disease.

10. Travellers going to and from the downtown by private auto are exposed to greater concentrations of carbon monoxide than are those travelling by public transit.

11. The amount of carbon monoxide at street-level is about three times greater in the city core than in the suburbs.

12. Epidemiological research has shown a clear statistical relationship between the incidence of non-occupational lung cancer and geographical areas of high air pollution such as the industrial and downtown areas of cities.

13. The greatest amounts of polycyclic aromatic hydrocarbons (approximately 15% of which are cancer inducing) in the ambient air of Calgary occur in the city core at street level. Concentrations of PAH in this area are three to seven times greater than in the major suburban residential areas of the city. The major source of these PAH emissions is the internal combustion engine.

14. Peak and Black suggest that the downtown pedestrian may be subjected to six times as much PAH and seven times as many carcinogens as the suburban resident.

15. In terms of carbon monoxide and carcinogen inhalation, cigarette smoking constitutes a far more serious hazard than air pollution.

16. While data are available indicating that air pollution downtown does present a health problem, and that pollutant levels will increase with the increased use of automobiles in the area, the data cannot be expected to answer the following fundamental and crucial questions:

a. How much air pollution in the downtown environment are Calgarians willing to live with?

b. What priorities should be assigned to those activities "creating" pollution (e.g. auto use) and to those "suffering" because of it (e.g. downtown residential and pedestrian environments)?

c. Who is responsible for unacceptable levels of pollution; who should pay to reduce levels to within acceptable standards and how much is air pollution abatement worth in dollars and cents?

d. What will be the effect of increased pollution on the health of the people using, and living in the downtown?

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I. METEOROLOGICAL CONSIDERATIONS*

Urban air pollution potential depends primarily upon atmospheric stability and wind speed. The normally stable air near the ground can be modified by the imput of either solar or artificial heat. Pollutants tend to be uniformly distributed in this modified region which is called the "mixing layer". The depth of the mixing layer and the mean wind speed together determine the "ventilation", which may be viewed as the effectiveness of pollutant dispersion. Poor ventilation, known also as "stagnation", favours the build-up of pollutant concentrations. Good ventilation tends to keep the concentration low (Alberta Environment 1975, pg. 30).

In Calgary, ventilation is normally good in the spring and summer, poorer in autumn and at worst in winter. Because of the normally poor ventilation in winter and autumn, small variations in mean wind speed and atmospheric stability will have much greater influence on pollutant concentrations than they would have at any other time of the year (Alberta Environment, 1975, pg. 30).

As one might expect, the existence of large, high buildings in the downtown tends to disrupt the natural northwest to southeasterly flow of air, hampering further the dispersal of air pollutants. In addition, the deflection of normal air flow results in a variety of microclimatic conditions including wind tunnels and poorly ventilated "pockets" of high pollutant concentrations.

Apart from normal meteorological and physiographic conditions air quality downtown is very directly affected by (1) the creation of photochemical smog, and (2) the frequent occurrence of low level temperature inversions. In his article discussing the downtown's air quality, Tollefson noted the impact of photochemical smog and temperature inversions to be the following: (Tollefson, 1971)

A. Photochemical Smog

Essentially, there appears to be four major "ingredients" required to create photochemical smog. These include reactive hydrocarbons, oxides of nitrogen, a relatively calm and stable atmosphere and bright sunshine .

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*This section draws heavily upon Tollefson, 1971.

The reactive hydrocarbons include trace quantities (parts per billion) of unsaturated hydrocarbons known as olefines, which must be mixed together with oxides of nitrogen. Both of these ingredients are produced, mixed and emitted by the operation of the internal combustion engine. A relatively calm, stable atmosphere is required to trap the pollutants so that the concentrations will rise to a level at which a photochemical chain reaction will "kick off". In the presence of bright sunlight, this reaction will take place in an hour or two yielding products which, if in sufficiently high concentrations, can cause eye irritation, damage to plants, rubber cracking and loss of visibility.

The above four prerequisites are all characteristics of Calgary's downtown area. For example, in an examination of local meteorological records for 1969 it was found that on more than half of the days of that year the temperature was sufficiently high to permit photochemical smog to form if the other ingredients were present.

Production of photochemical smog is accompanied by the formation of certain oxidants. Tollefson suggests that if the concentrations of hydrocarbons and oxides of nitrogen continue to increase as the population and number of cars in Calgary grow, the oxident levels can be expected to increase and complaints from citizens about eye irritation are likley to follow.

B. Temperature Inversions

In the Los Angeles basin there is little evidence of photochemical smog concentrations at temperatures less than 50^{0}F. Under these conditions, however, rain generally washes the reactants out of the atmosphere so that the reaction does not take place. In Calgary, on the other hand, photochemical smog has been observed at temperatures well below 50^{0}F but under dry conditions in which the reactants are exposed to bright sunlight. Such conditions often occur in the late fall and early spring. During these periods Calgary suffers from many low level temperature inversions which cause the products of combustion emitted by the automobile to be trapped near ground level. In 1969, Calgary's atmosphere showed an inversion from ground level to the 300 ft. level 46% of the time. During many winter days there are inversion conditions around the clock.

Under such conditions there should be concern about the build-up of hazardous concentrations of carbon monoxide in the downtown area when there is heavy traffic, and little or no wind. Relatively little is known about the concentrations of carbon monoxide which exist at street level under these conditions.

During inversions automobile exhaust (with CO emission enhanced by cold winter temperatures and the altitude) will concentrate in the downtown area. Prevailing westerly and north-westerly winds can direct this pollution along the banks of the Bow River, whose 200 foot deep valley will tend to delay its dispersal (Smith, 1975, pg. 2). Furthermore, during December, when downtown shopping is at a peak, average monthly wind speed is at a minimum, further limiting pollution dispersal (Annual Meteorological Report, 1974).

II. Air Pollution Sources

In downtown Calgary there is very little air polluting industry, per se. For the most part the major air pollutants in the area result from automobile emissions. The concentration level of such pollutants depends in part on the number and speed of vehicles operating within the area and the extent to which physical and meteorological conditions act to hasten or retard the dispersion of pollutants. While certain of these pollutants have been found to be hazardous to human health, the effects of many pollutants have not yet been fully explored, nor have their potential long term and cummulative effects.

A. Monitoring Stations

With the exception of occassional air quality studies such as those which will be discussed in the following two sections, the collection and analysis of air pollution data in the downtown area is generally the responsiblity of the Provincial Department of the Environment, Alberta Environment. Even when more comprehensive studies are undertaken they often rely on the data collected by the department or make use of the department's equipment and sampling locations.

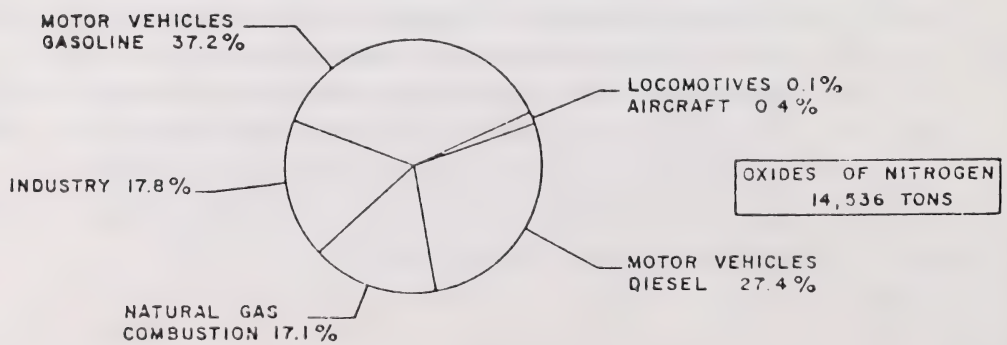
The major air quality monitoring station in the downtown is situated in the J. J. Bowlen Building, located at 6 St. and 7 Ave. S.W.. The air inlet is situated at a height of 10 meters above grade; the building itself is 30 meters high. The station is capable of monitoring the following pollutants: SO_2, NO_x, O_x, CO and THC. In addition, a high-volume sampler is located atop the roof of the City of Calgary Police Station, 316-7 Ave. S.E.. The sampler is positioned approximately 35 feet above street level.

The following discussion presents a precis of the information in a recent Alberta Environment publication (Alberta Environment, 1975) dealing with air pollutant sources and levels in downtown Calgary.

B. Pollutants

1. Oxides of Nitrogen

The oxides of nitrogen are composed of two major constituents; nitrogen dioxide (NO_2) and nitric oxides (NO). Essentially, both pollutants are a product of the high temperature (in excess of 2000 ^{o}F) oxidation of atmospheric nitrogen. Although the NO_2 emission is usually less than 0.5% of the total oxides of nitrogen, exhaust gas dilution and subsequent oxidation as well as photochemical oxidation give rise to NO_2 production. The source and omission inventory illustrated below indicates that motor vehicles account for more than half of the oxides of nitrogen emissions.



Epidemiological studies of the effect of nitrogen dioxide on community health have shown a significant correlation with increased respiratory disease at mean 24-hour concentrations between 117 and 205 ug/m_3 (0.062 and 0.109 ppm). These NO_2 levels constitute the lower documented pollutant effect range and care should be exercised in the data interpretation since synergistic effects from other air pollutants may be involved. The monitored NO_2 and NO_x levels in the city of Calgary indicate that daily averages in excess of 0.06 ppm were recorded periodically, particularly during the winter months, and therefore existing nitrogen dioxide levels constitute a potential health hazard, especially to sensitive individuals. Generally, the toxicological effect of NO is minimal when compared to NO_2.

2. Ozone

The production of ozone results from a photochemical oxidation process involving the interaction of nitrogen oxides, ultraviolet light energy and reactive hydrocarbons. It was found that the downtown area station, CDMU, recorded a low frequency of violations and relatively low ozone levels.

3. Total Hydrocarbon (THC)

The source/emission information indicates that motor vehicles are the primary source of hydrocarbon emissions in Calgary.

Hydrocarbons receive the most important consideration as precursors of other compounds formed in the atmospheric photochemical system. Although air quality standards do not presently exist for hydrocarbons (as there has been no demonstration of any direct health effects of the gaseous hydrocarbons in ambient air on populations), it is widely suspected that many of the effects attributed to photochemical smog are indirectly related

to ambient levels of these hydrocarbons.

The highest THC levels have been monitored at the downtown area station, CDMU. However, Alberta Environment suggests that present information is insufficient to conclude that existing hydrocarbon levels in the city present a general health hazard.

4. Carbon Monoxide (CO)

On a total mass emission basis carbon monoxide is by far the most abundant pollutant, comprising 73% of the total air pollution emissions in Calgary. Motor vehicles contribute almost all of the carbon monoxide and, consequently, it is not surprising that in comparing data from the city's three continuous monitoring stations, one finds the highest frequency of violations at the downtown area station, CDMU, both on an hourly and 24-hour basis. Further, CO levels were generally higher in the fall and winter months, with all of the readings in excess of provincial air quality standards being recorded during this period.

The health effect of carbon monoxide at low concentrations manifests itself primarily in the production of carboxyhemoglobin (COHb) levels in the blood; levels which have been associated with impaired performance on psychomotor tests*. As carbon monoxide is inhaled it joins with hemoglobin present in the lungs to form carboxy-hemoglobin. Hemoglobin is used by the body to deliver oxygen to body tissues and, as a greater proportion of the available hemoglobin is combined with carbon monoxide, a decreasing proportion is available for the delivery of oxygen, hence, less oxygen is circulated to the body's tissues. Impaired time interval discrimination was noted with an exposure of 8 or more hours to a CO concentration of 12-17 mg/m^3 (10-15 ppm) with an associated COHb level of 2.0 to 2.5% in non-smokers. It should be remembered that cigarette smokers generally have a COHb level with a median value of 5%; whereas non-smokers, in air which has very little CO, are usually found to have about 0.5% COHb.

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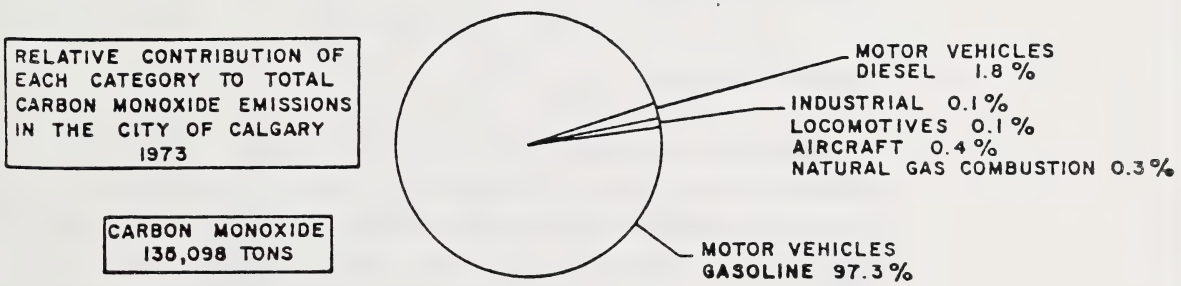
*Quoted from "Air Quality Criteria for Carbon Monoxide", U.S. Department of Health, Education and Welfare, Publication #AP-62.

The source and emission inventory illustrated below indicates that motor vehicles accounted for approximately 97.3% of all CO emissions in Calgary in 1973.


RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL CARBON MONOXIDE EMISSIONS IN THE CITY OF CALGARY 1973
CARBON MONOXIDE 135,098 TONS
MOTOR VEHICLES DIESEL 1.8 %
INDUSTRIAL 0.1 %
LOCOMOTIVES 0.1 %
AIRCRAFT 0.4 %
NATURAL GAS COMBUSTION 0.3 %
MOTOR VEHICLES GASOLINE 97.3 %

6. Particulates (Soiling Index, Hi-Volume, Total Dustfall)

Particulate matter in the atmosphere is composed of a large variety of substances, and encompasses any matter dispersed in the air, whether solid or liquid, in which the individual particles are larger than small molecules but smaller in diameter than 500 microns. The source emission information for the Calgary area indicates industry to be the prime source of particulate emissions. It should be remembered, however, that dust from natural sources such as wind erosion or dust related to construction activities is not considered in the source emission information.

With regard to suspended particulates, data monitored by use of high-volume samplers indicate that the highest suspended particulate levels were obtained in the downtown area and the lowest levels in the residential areas. On an annual geometric

mean basis the downtown area station and the industrial area station were in excess of the provincial annual standard of 60 ug/m^3 and almost twice the level monitored at the residential area stations.

Based on the existing high-volume suspended particulate levels in Calgary and available effect information, one can conclude that the higher levels constitute a nuisance potential but are not a health hazard due to the fact that monitored sulfur dioxide levels are relatively low.

C. Air Quality Index

In order to provide the public with a simple, readily comprehensible indication of downtown air quality on a daily basis an air quality index was developed in 1972. The report is released to the media on a daily basis using air monitoring data from the downtown area station, CDMU. Although a certain amount of oversimplification is inherent in any air quality index, it does relate downtown air quality to provincial standards and can serve a useful purpose as a public information vehicle.

Air monitoring data from the downtown area for September, October and November, 1975 have been presented in Table 1. Data are given for monthly mean, hourly peak and daily peak readings. With the possible exception of ozone, pollutant concentrations generally tend to increase from September to November. As would be expected, hourly peak levels generally exceed daily peaks, which in turn exceed monthly peaks. In the final column, Alberta air quality standards for each pollutant are given. This information clearly illustrates that downtown air pollutant concentrations do exceed the provincial standards by a very substantial margin. In the air monitoring report which discusses the data given in Table I, it was noted that for the three month period the following standards were exceeded:

Total Oxides of Nitrogen

September- twenty six, 1 hour averages and five, 24 hour averages exceeded their respective provincial standard

October - fourty six, 1 hour averages and five, 24 hour averages exceeded their respective provincial standard

TABLE 1
AIR MONITORING DATA
DOWNTOWN CALGARY
SEPTEMBER, OCTOBER AND NOVEMBER, 1975

POLLUTANT	MONTHLY MEAN (ppm)			HOURLY PEAK (ppm)			DAILY PEAK (ppm)			ALBERTA STANDARD
	Sept.	Oct.	Nov.	Sept.	Oct.	Nov.	Sept.	Oct.	Nov.	
Total Oxides of Nitrogen	0.09	0.08	0.11	0.54	0.50	0.69	0.13	0.24	0.41	1 hr: 0.21 ppm 24 hr: 0.11 ppm
Ozone	0.01	0.01	0.01	0.05	0.04	0.03	0.02	0.03	0.01	1 hr: 0.05 ppm 24 hr: 0.015 ppm
Reactive Hydrocarbons	0.20	0.34	0.43	1.00	2.10	3.10	0.50	0.73	1.40	
Carbon Monoxide	2.60	2.9	3.40	17.0	20.0	28.0	4.40	5.50	12.0	1 hr: 13.0 ppm 8 hr: 5.0 ppm
Sulphur Dioxide	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.01	½ hr: 0.20 ppm 1 hr: 0.17 ppm 24 hr: 0.06 ppm
Alberta Combined Air Quality Index	7	8	10	33	56	66	12	20	31	

Source: Calgary Air Monitoring Report, Fall Quarterly Summary, September, October and November, 1975, Station CDMU, Pollution Control Division, Alberta Environment, 1976.

November - one hundred and ten, 1 hour averages and twelve, 24 hour averages exceeded their respective provincial standard

Ozone

September - two, 1 hour averages and three, 8 hour averages exceeded their respective provincial standard

October - three, 1 hour averages and nine, 8 hour averages exceeded their respective provincial standard

November - twenty one, 1 hour averages and fourteen, 8 hour averages exceeded their respective provincial standard

Suspended Particulates

September - two out of three, 24 hour samples exceeded the provincial standard with a peak of 220 micrograms per cubic meter

October - two out of three, 24 hour samples exceeded the provincial standard with a peak of 234 micrograms per cubic meter

November - three out of three, 24 hour samples exceeded the provincial standard with a peak of 276 micrograms per cubic meter

In considering these observations one must bear in mind that because of the monitoring apparatus being positioned 10 meters above grade the concentrations of pollutants at grade may be significantly higher. For example, in Smith's study it was found that "on all 24 days for which hourly street CO measurements were made, street levels of CO exceeded levels of CO measured by the downtown monitor of Alberta Environment " (Smith, 1975, pg. 5). In their study of carcinogenic hydrocarbons, Peak and Black noted that;

> "Under average wind conditions in Calgary of 10 mph there is rapid mixing and dispersion of PAH pollutants in the downtown area so that concentrations at the third floor building level are three to four times less than at the street level". (Peak and Black, 1975, pg. 57).

further, Smith also observed that: (Smith, 1975, pg. 6)

> "While not fluctuating as much as the street levels, the CO levels inside downtown buildings remained, on the average

well above the ambient levels measured at the fourth floor level for the same day by the downtown monitor of Alberta Environment."

III. CARBON MONOXIDE*

A. PROJECT DESCRIPTION

A study of both indoor and outdoor carbon monoxide (CO) exposure was conducted in Calgary, Alberta, from September, 1973 through March, 1974. Two areas of the city, with very different ambient CO exposure conditions, the suburban campus of the University of Calgary and the central business district, were studied as well as a special group with occupational exposure, i.e. automobile parkade employees.

The presence of carbon monoxide (CO) in the lower atmosphere or ambient air is a potential hazard for large urban centers such as Calgary because of the high density of motor vehicle traffic, (the source of 97% of the outdoor exposure to carbon monoxide in this city (Western Research, 1973)). Besides CO produced by incomplete combustion of motor fuel, the urban resident is exposed to CO in cigarette smoke and to some degree in private houses from fuel fired heating and cooking. Furthermore, occupations have developed, such as automobile mechanic and auto parkade attendant, in which individuals are exposed to higher concentrations of CO from motor vehicle exhaust than are found in outdoor air.

Concern over CO exposure in the urban environment grows as data accumulates, indicating that very low levels of CO, 15-20 ppm, sufficient to cause 2.5 to 3.0% carboxyhemoglobin (hemoglobin combined with CO, abbreviated as COHb) at equilibrium, can produce undesirable health effects, particularly to those individuals already impaired by cardiovascular disease (Aronow, 1972; Aronow and Isbell, 1973; Anderson et al, 1973).

Because of these concerns, the primary objective of this paper is to present data to assess and compare the importance of both indoor and outdoor CO exposure in several urban groups in Calgary, Alberta:

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* The following description is a precis, taken verbatim, from N. Smith, C. A. Guenter, G. Hodgson, "Community Exposure to Carbon Monoxide in Calgary, Alberta", Environmental Science Centre (Kananaskis) and the Faculty of Medicine, University of Calgary, 1974.

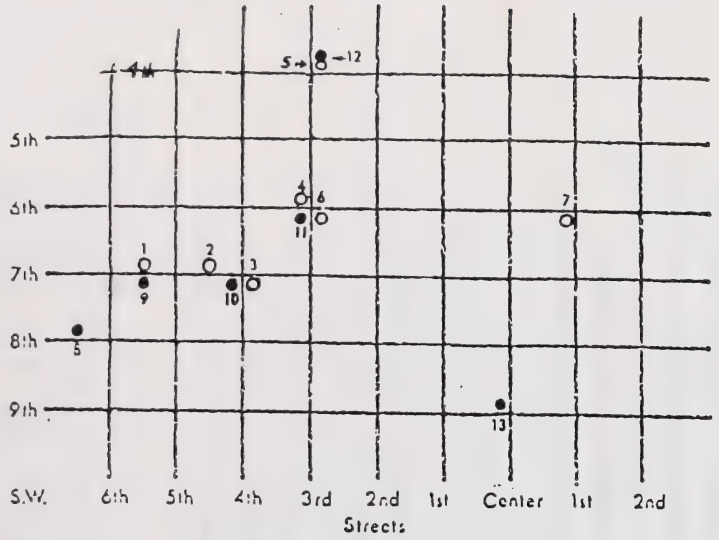
(a) Persons exposed to the highest amounts of outdoor and indoor ambient CO--office and store personnel in the downtown area of Calgary.

(b) Persons exposed to a presumed minimal amount of outdoor and indoor ambient CO during the working day--students and employees in a suburban setting, the University of Calgary.

(c) A special group with occupational exposure--automobile parkade employees.

Measurements of carbon monoxide in the ambient air were made continuously inside buildings and by hourly spot checks at the adjacent street level for thirteen locations (Figure 1) for three days each in the central business district. Comparable measurements were also made seven days on the campus of the University of Calgary. Testing was conducted during the fall and winter seasons of 1973-74 (with some additional tests in 1974-1975).

Sequential hourly sampling of expired air was conducted for employees during the eight hour work day at each of the work sites. In addition employees of two parkades, a university laboratory and a downtown office building were asked to give an expired air sample one morning both before smoking and before leaving their home.



O Buildings, 1-7

● Automobile parkades, 8-13

Fig. 2. Location of Testing Sites in the Central Business District of Calgary.

1. Eleven story office building, central air conditioning, sealed windows, air intake for first floor measuring site located on third floor, air intake for fourth and tenth floor measuring sites located above eleventh floor.

2. Two story museum, no central air conditioning, unsealed windows, air intake fan located at ground level on north side of building to ventilate basement. Measurement sites: basement, first and second floor.

3. Four story department store connected to parkade by understreet walk way, separate air intake for each floor except basement located at ceiling height for each floor along 7th Avenue. Air intakes for basement located at roof level, unsealed windows. Measurement sites: basement, first, mezzanine, second and fourth floors.

4. Seven story office building, central air conditioning, sealed windows, air intake located at equivalent height of nine floors. Measurement sites: first, fourth, and seventh floors.

5. Seventeen story (minus thirteenth floor) hotel, central air conditioning, sealed windows, air intake for second through seventeenth floors located above seventeenth floor; for second floor banquet room, lobby and part of lower shop area located at second floor, for ground floor at street level. Measurement sites: ground floor, lobby, fourth and sixteenth floors.

6. Six story older office building, no central air conditioning, unsealed windows. Primary measurement sites at two locations on ground floor. Ambient air samples also taken on second, fourth, and sixth floors.

7. Two story older office building, no central air conditioning, unsealed windows. Measurement sites on first, and second floors.

8. Automobile parkade, covered, above ground, 250 stalls.

9. Automobile parkade, covered above ground, 320 stalls.

10. Automobile parkade, covered, above ground, 300 stalls.

11. Automobile parkade, covered, above ground, 178 stalls.

12. Automobile parkade, underground, 275 stalls.

13. Automobile parkade, covered, above ground, 465 stalls.

FIGURE 1: LOCATION OF TESTING SITES IN THE CENTRAL BUSINESS DISTRICT OF CALGARY

In order to estimate CO exposure while employees were in transit to these sites, CO levels were measured inside buses and automobiles in rush hour traffic during December and January.

CO levels were measured each day inside the City of Calgary transit buses at five minute intervals during round-trip transit from the University of Calgary to downtown Calgary and for both daily rush hours and mid-day for two weeks in December and two weeks in January.

B. OBSERVATIONS

1. Exposure to Ambient Air Outside

Street levels of carbon monoxide (CO) downtown exceeded the Alberta one-hour standard of 13 ppm (Table 2) and the 8 hour standard of 5 ppm for 23 out of the 24 days tested for 8 hour average CO levels (Alberta Department of the Environment, November, 1973).

The peak downtown hourly average (on the basis of 5 spot samples ranging up to 125 ppm) was 71.5 ppm, which occurred on January 21, 1974, between 5:00 p.m. and 6:00 p.m. on Ninth Avenue between Center Street and First Street S.W.

In general, peak levels were measured in December and January. For five of the fifteen days tested during these months, levels of CO in the downtown area reached concentrations that could produce health effects: daily average levels of 18-20 ppm with peak measurements of CO in the afternoon's heavy traffic flow of 35-50 ppm lasting one to two hours. In contrast, throughout most of the testing period of mid-September to mid-February, street levels of CO generally were lower with average daily levels less than 10 ppm and rush hour peaks measuring 15-20 ppm.

TABLE 2: EXPOSURE TO CO(ppm) BY LOCATION

Location	8-Hour Average			Peak Hourly Average
	Mean ± SD	N*	Range	
Parkade Ticket Booth	33.3 ± 15.9	14	16.8 – 65.2	240.0
Mechanics Work area-Parkade	63.0 ± 29.8	6	27.0-107.9	250.0
Office-Store-Interior	7.7 ± 3.3	14	3.0 – 15.0	35.0
Street-Central City	7.6 ± 13.1	24	5.2 – 24.4	71.5
University Office-Lab	2.7 ± 1.5	7	1.5 – 5.0	18.0
Street-University	3.0 ± 1.8	7	1.6 – 6.0	19.0
Rural-Kananaskis Valley	<0.5	2	0 – 0.5	0.5

*Number of 8-hour averages, the average concentration of CO over the eight hour work day.

TABLE 3: EFFECTS OF THE LEVEL OF AIR INTAKE ON THE CONCENTRATION OF CO - FRIDAY, DECEMBER 21, 1973, BETWEEN 5:30 - 6:00 p.m.

Site	Building Type	CO Level by Floor (ppm)
2	Two story older museum. No central air conditioning.**	12 ppm, floor 1 and 2
3	Four story older department store. Air intake for each floor located on each floor-ground floor intake on roof, but connected by tunnel to parkade.	Ground: 50; 1st: 34; 2nd: 22; 3rd: 24; 4th: 22. Rest area for customers on ground floor: 72
6	Six story older office building. No central air conditioning.**	1st: 23; 2nd: 25; 4th: 20; 6th: 19
4	Seven story modern office building. Air intake on roof.	1st: 20; 4th: 17; 7th: 18
*	Fifteen story modern office building. Air intake on roof.	1st: 8; 7th: 7; 15th: 7

2. Indoor Levels of Carbon Monoxide

Offices and stores in the central business district had much lower levels of CO than parkades, although higher than the University of Calgary (Table 2). Their mean 8 hour CO,level 7.7 ppm, was slightly above the Alberta standards. However, both the peak 8 hour average of 15.0 ppm (out of a range of 3.0 to 15.0 ppm); and the peak hourly average, 35.0 ppm (measured at ground level, location 6), were above the Alberta standards for ambient air and sufficient to pose a potential health problem to persons with heart disease. Peak levels of CO in buildings were also found in December. For example, between 4:00 and 7:00 p.m. in the Christmas week, bag samples of room air measured between 15 and 30 ppm CO in four buildings tested that week on Sixth and Seventh Avenues as compared to previous high readings of 12 to 18 ppm.

Data collected during December suggest the effect of height of the air intake and type of ventilation on severity and uniformity of CO levels reached in each building (Table 3). The first three buildings are older, lack sealed windows, and freely admit ambient air at each floor. The difference in their readings relates to the noticeable difference in traffic density at their respective locations. The latter two are modern high rise buildings. The difference between the two groups relates to a difference in the levels of their air intakes (in both cases above the top floor). These findings were confirmed by measurements in the six-story older building and the seven-story modern structure located on the same busy intersection. The consistently higher levels of CO in the lower floor of the older building reflected again the lack of sealed windows, in effect a ground floor level air intake.

One particularly serious ventilation problem involved the basement floor of a building connected to a parkade across the street by an underground tunnel. The tunnel served as a natural conduit allowing the automobile exhaust fumes to enter the building. A rest area with chairs linked the tunnel with the building. Here brief measurements by the continuous monitor showed CO concentrations of 175 ppm for 10 minutes and 90 ppm for two separate spans of one hour. Spot checks by sample bags in this area ranged from 20-100 ppm CO.

Figure 2, showing hourly averages determined from fourteen days of data, demonstrates how room air in these buildings closely followed the outside ambient levels of CO. While not fluctuating as much as the street levels, the CO levels inside downtown buildings remained on the average well above the ambient levels measured at the fourth floor level for the same day by the downtown monitor of the Alberta Department of the Environment. The morning peak was particularly pronounced for all three sources of data.

3. Parkades: An Example of Special Occupational Exposure

Parkades measured the highest levels of CO as compared to other building types: a mean 8 hour level of 35.3 ppm in the ticket collection booth (referred to as "room" in all figures) of six parkades with a standard deviation of 15.9 ppm, a range of 16.8 to 65.2 ppm, and a peak hourly average of 240 ppm (Table 2). Out of 14 days of testing in the six parkades, four days (two in January, two in October) in the ticket booths of three parkades measured 50 ppm or more for an 8 hour average.

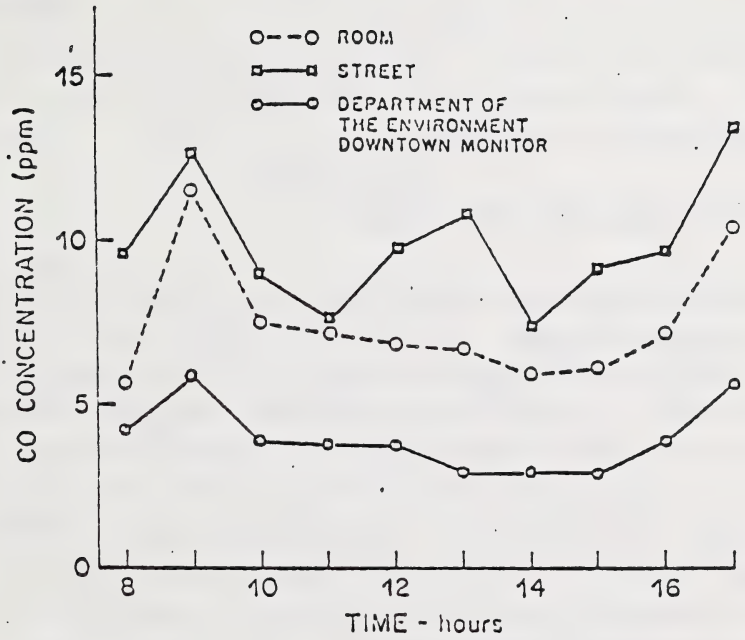


Fig. 5. Average CO levels during the work day in downtown Calgary for the interior (Room) of office buildings and stores, for street level outside these buildings, and for the Calgary downtown CO monitor of the Alberta Department of the Environment. Each data point represents an average of 14 days of data for that hour, September through December, 1973.

FIGURE 2: AVERAGE CO LEVELS DOWNTOWN IN SPECIFIC LOCATIONS

Moreover, areas where mechanics worked on automobiles measured still higher, even though mechanical exhaust systems were present in each area. Here the mean 8 hour CO level was 63.0 ppm with a standard deviation of 29.8 ppm, a range of 27.0 ppm. Measurements of CO on 6 out of 10 days in the work areas of auto mechanics reached 50 ppm or more for an 8 hour average. Figure 3 represents the average hourly levels of CO using data from all the parkades tested. It shows a minor morning and noon rise and a major rise of CO concentrations in the evening.

4. Exposure to CO in Buses and Automobiles

Employees in Calgary expose themselves to considerable CO while travelling to work. During ten twenty-minute automobile trips, the automobile interior averaged 31.5 $\pm$ 6.0 ppm going to work and 26.2 $\pm$ 2.0 ppm going from work with a peak average of 66.7 ppm (45 minute trip). The 45 minute trip included a 20 minute period in a traffic jam during which the interior level of CO continuously exceeded 100 ppm. Bus trips were lower and ranged in averages from 10.1 $\pm$ 6.3 ppm for four trips going from the city center in the morning to 19.5 $\pm$ 9.5 ppm for 12 trips going from the city center at the evening rush hour.

5. COHb Levels in Employees

Smokers in the office buildings averaged three times as much COHb in their blood as nonsmokers. The mean of their respective eight-hour averages was 5.8 $\pm$ 2.3 and 1.7 $\pm$ 0.6 with a range of 2.1 - 11.1 and 1.0 - 3.4% COHb respectively (Table 4). Their respective end-workday average levels were 6.8 $\pm$ 2.2%, range

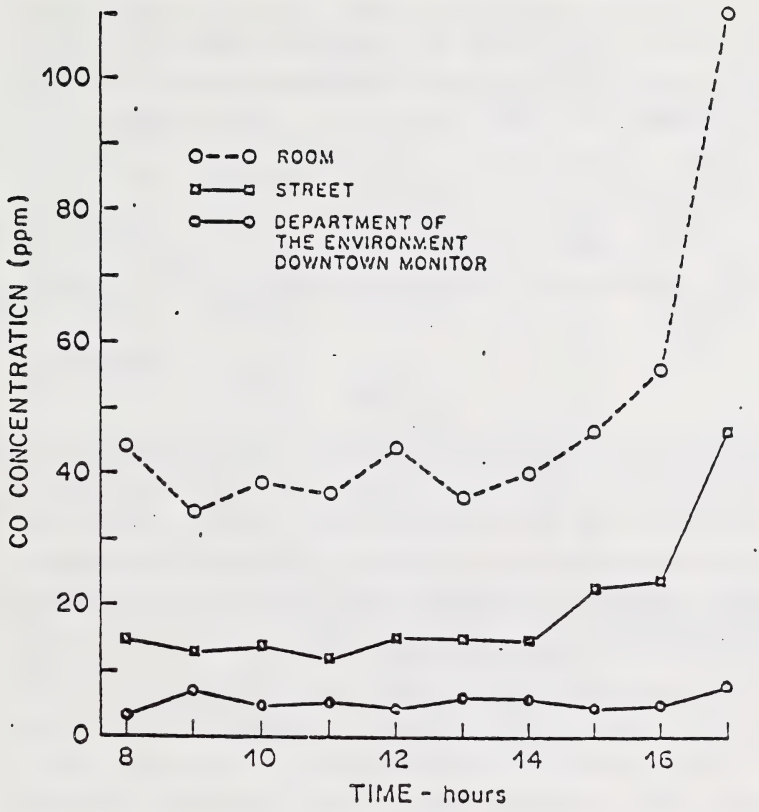


Fig. 8. Average CO levels during the work day in downtown Calgary for room air in the ticket booths of automobile parkades, for street level outside these buildings and for the downtown Calgary CO monitor of the Alberta Department of the Environment.

Each data point represents an average of 14 days of data for that hour, September, 1973, through February, 1974. Note that each data point for level of CO in the room air and the ambient air measured by the Alberta Department of the Environment is not an average spot reading, as street level is, but represents the mean CO level for the preceding 60 minutes determined from a continuous record.

FIGURE 3: AVERAGE CO LEVELS DOWNTOWN - PARKADES

TABLE 4: CARBOXYHEMOGLOBIN LEVELS (% $COHb$) DETERMINED BY ANALYSIS OF EXPIRED AIR FOR OCCUPATIONAL GROUPS

A. COHb Levels (%).

Exposure Group	8-Hour Averages** Mean ± SD	N*	Range	Changes in COHb Between Morning and Evening Over 8-Hour Work Day Mean ± SD	Range	End Work Day Levels of COHb Mean ± SD	N*	Range
Parkade Employees								
Smokers	8.5 ± 3.0	19 x 2	3.4 - 16.9	4.5 ± 3.9	0.0 - 16.2	10.5 ± 5.1	19 x 2	3.4 - 23.4
Nonsmokers	4.6 ± 2.3	10 x 2	2.7 - 9.5	3.2 ± 4.5	1.1 - 10.6	6.9 ± 3.4	10 x 2	2.6 - 13.2
Office-Store Employees				Pre-December	Pre-December			
Smokers	5.8 ± 2.3	35 x 2	2.1 - 11.1	0.0 ± 1.7	-3.2 to 4.5	6.6 ± 2.2	31 x 2	2.0 - 15.3
Nonsmokers	1.7 ± 0.6	47 x 2	1.0 - 3.4	-0.1 ± 0.9	-3.0 to 2.9	1.7 ± 0.7	47 x 2	1.0 - 3.8
				December	December			
			Smokers	1.0 ± 2.0	-4.0 to 4.2			
			Nonsmokers	0.4 ± 0.8	-1.1 to 2.5			
University								
Smokers	4.1 ± 3.0	9 x 7	1.9 - 9.6	0.2 ± 1.3	-1.1 to 3.2	4.6 ± 3.5	9 x 7	1.8 - 10.9
Nonsmokers	0.9 ± 0.2	9 x 7	0.8 - 1.3	-0.1 ± 0.3	-0.7 to 2.3	1.0 ± 0.3	9 x 7	0.6 - 1.7

N = Number of employees times the number of days of testing for each employee to give the total number of 8-hour averages used to determine the mean.

** A single 8-hour average equals the average concentration of COHb in the blood of an employee over an eight hour work day.

2.0 - 15.3% and 1.7 ± 0.7% COHb, range 1.0 - 3.8%. Figure 4 illustrates the levels of CO attained by a smoker and a nonsmoker in an older building on the ground floor at a busy intersection. The expired air of the smoker remained well above that of the room air and close to 15-20 ppm (3.4% COHb) higher in COHb than the nonsmoker throughout the day. Thus the smoker was actually adding to the CO level in the air. At the end of the workday, 80 percent the smokers had COHb levels greater than 5% and only 8 percent of greater than 10%. Smoking parkade employees on the average had twice the CO in their blood as did nonsmokers, 8.5 ± 3.0% COHb as compared to 4.6 ± 2.3% COHb for an 8 hour average.

C. CONCLUSIONS

As the data and discussion above suggest, nonoccupational, nonsmoking exposure in Calgary is probably no immediate problem for healthy people. However, ambient street levels and interior levels of CO occasionally occur in the downtown area that can produce 2.5 to 3% CPHb. This range of COHb levels does have possible health consequences to the people with cardiovascular disease. Peak CO levels measured at street level, inside buses and particularly automobiles, inside parkade ticket booths and auto repair areas, and on the ground floors of unsealed buildings in downtown Calgary were sufficiently elevated to be a health hazard to older persons with latent heart disease. Late afternoon winter street levels of CO rose frequently to 35 - 40 ppm for up to two hours with a peak hourly level of 72 ppm. Data for COHb and CO levels also indicatedthat CO exposure either on the street or inside buildings is not a health problem for suburban areas of Calgary with the same CO exposure as measured at the University of Calgary; smoking was the primary CO exposure. For smokers in parkades, the data suggested that smoking and occupational exposure are probably equally important sources of CO. Parkade levels of CO (as much as 240 ppm) indicated the need for serious revision of ventilation requirements in parkades.

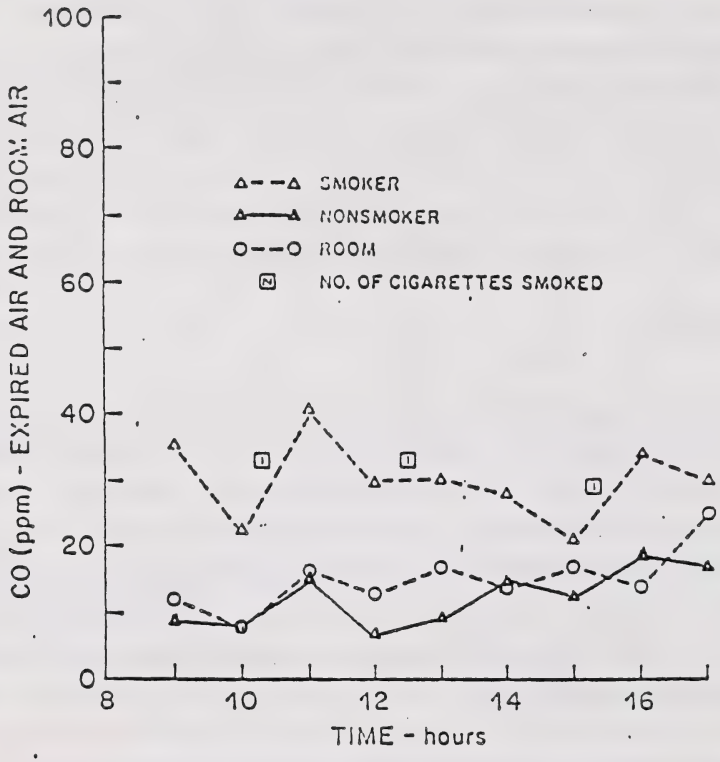


Fig. 10. The CO levels of the room air and of the expired air of a smoker and a nonsmoker - office building (no central air conditioning), 6th Avenue and 3rd Street, S.W., September 24, 1973.

FIGURE 4: CO LEVELS - SMOKERS AND NON-SMOKERS

For all groups both environmental and smoking exposure to CO were additive. However, environmental CO exposure was primarily important to nonsmoking employees of the office buildings and stores in the downtown area. This exposure was due to the elevated CO levels in buses and particularly automobiles during rush hour traffic and to CO-laden street level air seeping into older buildings and occasionally into the intake vents of the newer high rises. Most of the time (95%) nonsmokers were well below the 3% COHb level at which impairment of coronary heart disease patients or psychomotor changes begins.

Carbon monoxide exposure has been examined* in four occupations which involve extensive time spent driving on city streets: bus and taxi drivers, policemen, and commissionaires (parking ticket officers). In general, number of cigarettes smoked per day and the amount of time since one last smoked had the greatest effect of carboxyhemoglibin (COHb) levels. Differences among bus drivers in hours spent driving or outside correlated poorly with differences in end-working COHb levels but did explain part of the variance in COHb levels in police constables. COHb levels tended to be inversely related to age. Nonsmoking bus drivers had levels of COHb, less than 2.0% COHb, comparable to those found by a previous study in office workers and clerks in the downtown area of Calgary. Nonsmoking police and taxi drivers had higher COHb levels, averaging between 2.5 to 3.5%, the level at which people with cardiovascular disease begin to experience measurable adverse effects. This finding was in agreement with the more elevated CO levels previously found in automobiles as compared to buses. All four driving occupations had average COHb levels in nonsmokers ranging from approximately 2 to 3 times the average levels measured both previously and in this study in nonsmoking personel at the suburban university of Calgary. Peaks

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* Smith, Dr. Nancy Johnson, Occupational and Community Exposure to Carbon Monoxide in Calgary, Alberta, Part II: Motor Vehicle Oriented Occupations, Calgary, Environmental Sciences Centres (Kananaskis), University of Calgary, November, 1975.

close to 5% COHb in both taxi drivers and policemen were within the range reported in the literature which measurably affected the psychomotor responses of healthy individuals and seriously affected the cardiac performance of those with cardiovascular disease. Because of the large number of taxi drivers over 40 years old, this finding is a concern. The majority of commissionaires (86%), bus drivers (55%) and taxi drivers (76%) were present smokers as compared to less than 50% for the general Canadian adult population (47% for males, 32% for females). As a result of smoking, taxi drivers had peak levels of 12.0% COHb, bus drivers 11.0%, and policemen 14.6%. Smokers in most of the occupations tested averaged approximately 20 cigarettes per day, while commissionaires averaged 30. The average age for starting to smoke was 15-17 for all smokers. Thus because of the large number of smokers the risk of developing heart disease is already elevated in these occupations. Additional CO exposure due to chronic exposure to auto exhaust may increase the risk of developing heart disease and adversely affect oxygen supply to the tissues.

IV. CARCINOGENIC HYDROCARBONS*

A. PROJECT DESCRIPTION

Chemicals in the workplace, the environment, and in the diet may be the single most important cause of human cancers (Maugh, 1974b). It is apparent that the vast effort of the past few years to develop cures for cancer has made only limited progress. Attention is now turning to other means of attacking the problem; to the causes of cancer, and particularly to chemical carcinogenesis. Scientists estimate that 60-90% of cancers are caused by environmental factors--mostly chemicals.

Epidemiological research has shown a clear statistical relationship between the incidence of non-occupational lung cancer and geographical areas of high air pollution such as the industrial and downtown areas of cities (Carnow and Neier, 1973). Urban air pollution has been implicated in the high rate of cancer in cities but due to the complex nature of the problem little definitive data are available on the exposure of urban dwellers to atmospheric carcinogens. This study provides such data for the inhabitants of Calgary.

In the atmosphere of the city center the internal combustion engine causes 99% of the carbon monoxide and likely a similar percentage of the PAH comes from this source. In an Alberta Environment (1971) report it was estimated that 70.9% of the hydrocarbon emissions in Calgary were due to the internal combustion engine. Thus the downtown business district with its high density of traffic, average of 127,400 vehicles from 7:00 a.m. - 11:00 p.m. on each weekday during May of 1975 (Calgary Planning Department), acts

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* The following description is a precis, taken verbatim from, Peak, Eric and Black, Karen, "Carcinogenic Hydrocarbons As Pollutants in the Atmosphere of the City of Calgary", Calgary, Environmental Science Centre (Kananaskis), University of Calgary, 1975.

as almost a point source of pollutants which under light wind conditions may move into the residential areas of the city primarily following the Bow River valley but also moving north along the Nose Creek valley (Figure 5).

The sampling method adopted in this study is widely used throughout North America. Atmospheric particulate matter is collected on a fiber glass filter and associated polycyclic aromatic hydrocarbons are then investigated. The backbone of the sampling program was a network of four sampling sites operated by Alberta Environment at locations shown on the City of Calgary planning map of Figure 6 and the topographic map of Figure 5. The four sites were:

(1) a downtown location - the roof of the City of Calgary Police station, 316 7th Avenue S.E. Sampler located about 35 feet above street level on the eastern edge of the main downtown core.

(2) an industrial location - at ground level of the Ogden meteorological tower in east Calgary. The meteorological tower is located well away from any specific sources of pollutants in a field at approximately 45th Avenue and Bonnybrook Road S.E.

(3) a residential location - at ground level in the back yard of a residence at 407 - 31 Avenue N.W. in north Calgary.

(4) a residential location - on the roof of a trailer - 10 feet above ground level at the meteorological site on the University of Calgary campus in west Calgary.

In addition to these sites, samples were taken using equipment from the Environmental Sciences Centre (Kananaskis) at:

(5) a downtown location - at street level outside the J.J. Bowlen building on the northwestern edge of the downtown core.

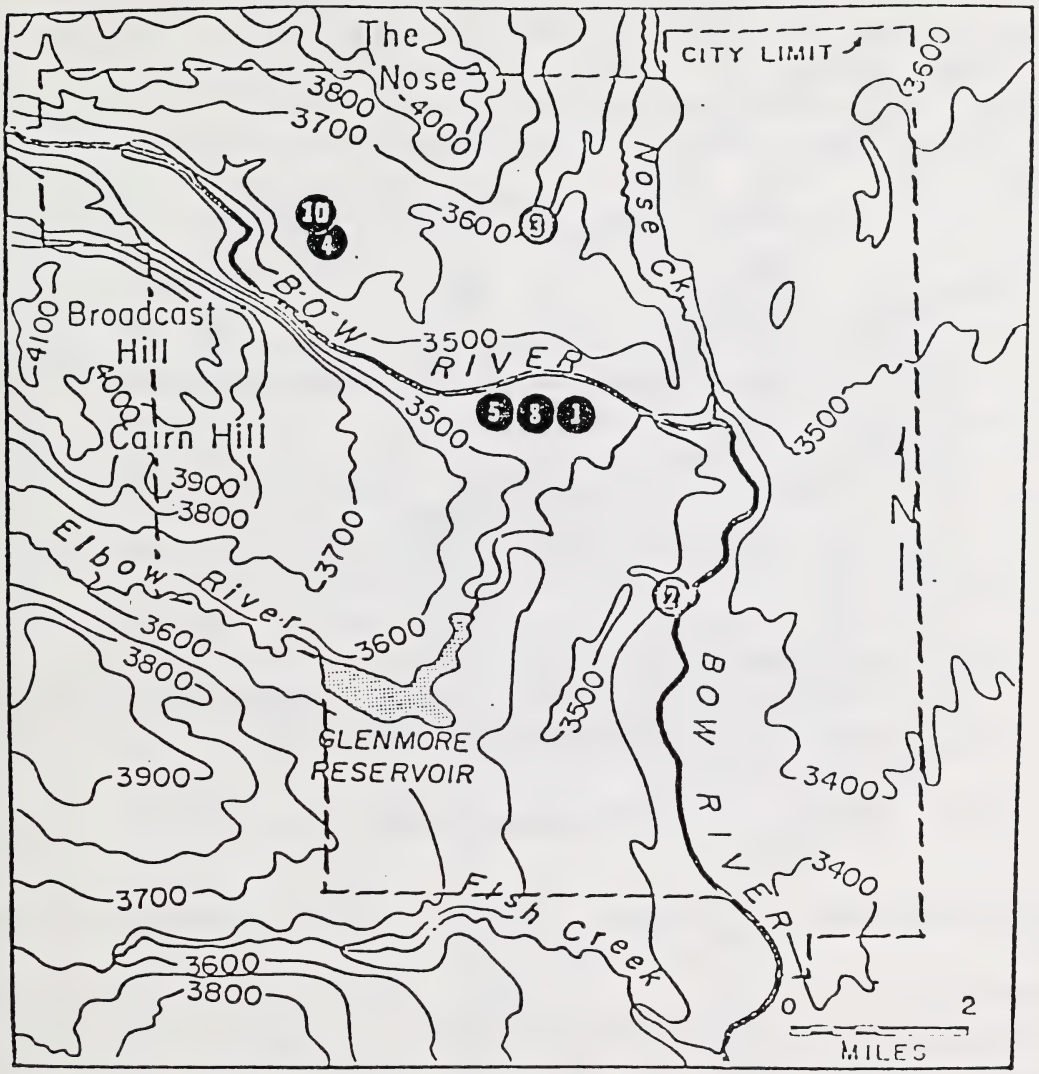

FIGURE 5: SAMPLING SITES AND CALGARY TOPOGRAPHY

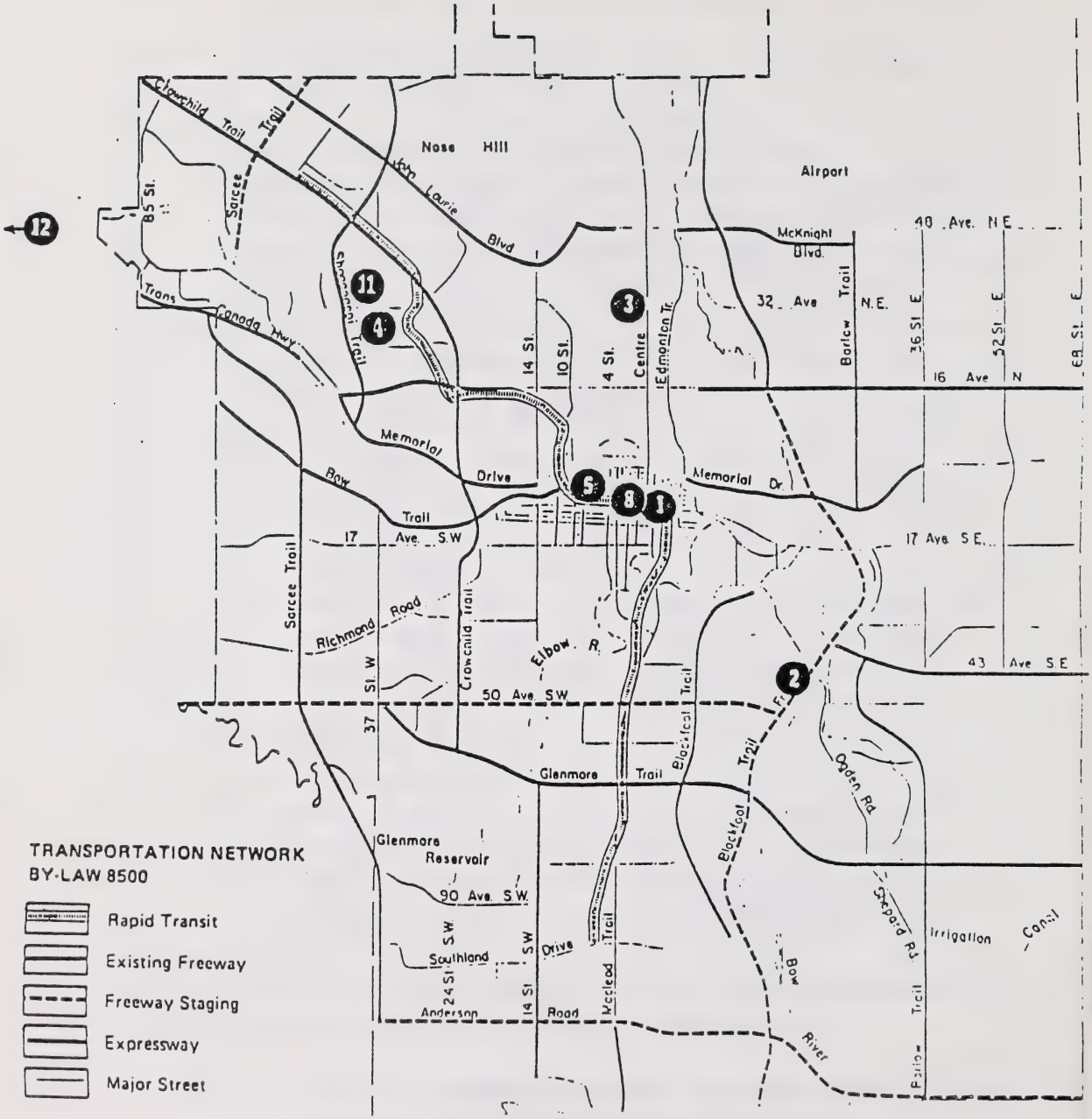

FIGURE 6: SAMPLING SITES AND MAJOR CALGARY ROADWAYS

(6) a downtown location - at the third floor level of the J. J. Bowlen building

(7) a downtown location - at the thirteenth floor level of the J. J. Bowlen building, 620 - 7th Avenue S.W.

(8) a downtown location - at street level outside the parkade at 112 - 9th Avenue S.W. in the central core of the city.

(9) a downtown location - roof top of parkade, approximately the 4th floor level.

(10) a downtown location - interior of parkade next to ticket dispenser.

The sampling period for atmospheric samples was usually 24 hours from midnight to midnight; however, in the case of downtown street level locations sampling periods were shorter, about 8 hours from 8:00 a.m. to 4:00 p.m., and at the rural location sampling periods of up to 4 days were used. In order to measure the build-up of pollutants with increasing traffic flow and the rate of dispersion of these pollutants consecutive one hour samples were taken on occasion for fourteen hour periods. In the case of vehicle exhaust samples the collection period usually was one hour. As the larger displacement engines emitted a greater volume of exhaust than the capacity of the sampler, collection was not total.

The number of samples collected from each site were as follows:

1.	Roof of police station	58
2.	Ogden Meteorological tower	55
3.	North Calgary residential	59
4.	University of Calgary	44
5.	J. J. Bowlen, street level	70
6.	J. J. Bowlen, 3rd floor	69
7.	J. J. Bowlen, 13th floor	70
8.	Parkade, street level	8
9.	Parkade, roof	8
10.	Parkade, interior	24
11.	West Calgary residential	12
12.	Kananaskis rural	6
	Vehicle exhaust	9
	Total samples	464

Detailed sampling at street level, the third floor level and the thirteenth floor level of the J. J. Bowlen building (sites 5, 6, and 7) on an hourly basis over one nine hour and one fourteen hour period provided information on the rate of mixing and dispersion of PAH from the street level transportation source.

B. OBSERVATIONS

Small but significant amounts of carcinogenic hydrocarbons were detected in the atmosphere of the city of Calgary. The most abundant carcinogens were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and o-phenylenepyrene with lesser amounts of up to fifteen other tumor initiators and tumor promotors. Concentrations of carcinogens in ambient air ranged from 1.8 ug/1,000 m^3 at downtown street level to 0.24 ug/1,000 m^3 at suburban locations.

Fifty five peaks in the GC-MS analysis of a composite air sample from site 10 in downtown Calgary were recognized as being aromatic hydrocarbons with a tentative identification being made of forty two of these. Based upon the fifty five peaks the total aromatic hydrocarbon content of the combined sample was 5.66 ug/1,000 m^3 of air. As the sampling location was about 40 feet above street level the amount of PAH at the pedestrian level would be considerably higher, about 12-15 ug/1,000 m^3. Of the 5.658 ug/1,000 of PAH measured in the atmosphere at the 3rd floor level of the city center location, about 0.85 ug or 15% consisted of carcinogenic compounds.

The major source of polycyclic aromatic hydrocarbons (PAH) in Calgary is the automobile resulting in the highest concentrations of PAH occurring in areas of high traffic density, i.e. at street level in the city center. Meteorological factors, primarily wind speed and the depth of the mixing layer, influence the dispersion of atmospheric PAH. The average Calgary wind speed of over 10 mph is favourable for the mixing and dispersion of pollutants as indicated by measurements of the vertical distribution of PAH. Amounts at the third and thirteenth floor building level were three to five times less than at street level. Although on occasion light winds moved pollutants

from the downtown area into the suburbs, street level concentrations were five to six times less in the north western suburban areas of the city than in the downtown area.

Locations in west Calgary showed the smallest amounts of polycyclic aromatics, an average of 80 ug/1,000 m^3 during the period September 1974 to February 1975, reflecting the direction of the prevailing winds from the north west, bringing in air from rural regions. Almost without exception the greatest amounts of polycyclic aromatics, average 277 ug/1,000 m^3, were found in the atmosphere on the eastern edge of the city center, i.e., down wind from the city center (average 122 ug/1,000 m^3 at the third floor level of the J. J. Bowlen building) again reflecting the general movement of pollutants away from the city center by prevailing winds from the north west.

The exposure of the downtown residents would vary greatly according to the type of building and its location. Unsealed downtown residences would have virtually street level amounts of PAH in the air. A resident of such a dwelling would be exposed to about 56 ug/yr of PAH of which 8.4 ug would be known carcinogens. In contrast the downtown resident in a modern sealed apartment building with its air intake above the fifth floor level would receive only the same exposure as the suburban resident and would inhale about 7 ug/year of PAH.

The pedestrian or downtown street level worker is exposed to about 12 ug/1,000 m^3 of PAH in the air he breathes. Based on an 8 hour exposure while performing light work during which the ventilation rate was 20/minute the downtown exterior worker would inhale about 29 ug of polycyclic aromatic hydrocarbons per year of which 4.3 ug would be known carcinogens.

C. CONCLUSIONS

In summary the greatest amounts of PAH in the ambient air of Calgary occur in the city core at street level. Concentrations of PAH in this area are 3 to 7 times greater than in the major suburban

residential areas of the city. The major source of these PAH emissions is the internal combustion engine which is the backbone of Calgary transportation, resulting in the highest traffic density being in the downtown area. Occasional relatively high concentrations of atmospheric PAH may occur in the suburbs as a result of light winds moving pollutants away from the city center usually to the north along the Nose creek valley or north west along the Bow River valley.

On a moderately windy day (average wind velocity of 12 mph) amounts were 3.6 times greater at street level than at the third floor level, which in turn were 1.3 times greater than at the thirteenth floor level. On a very windy day (average wind velocity of 26 mph) the same trend was found. Amounts at street level were 3.3 times greater than at the third floor level which were slightly higher than those at the thirteenth floor level. Thus on both days tested the majority of the street level pollutants, derived from motor vehicle traffic, were dispersed by the wind in the first 25 feet of elevation. Amounts of pollutants at all elevations were lower on the more windy day, 37% lower at street level, 31% lower at the third floor level and 26% lower at the thirteenth floor level.

After consideration of the elevation of the downtown sampling locations above street level it appears that the downtown pedestrian is subjected to 6 times as much PAH and 7 times as many carcinogens as the suburban resident. These results are in keeping with those obtained from fluorescence studies of crude cyclohexane extracts of the fiber glass filters. It should be noted that the composite sample consisted of samples from randomly selected days. The DOE air pollution index for these days ranged from 6 to 15 in the case of the NW area samples and from 6 to 19 for the downtown samples; indicative in all cases of "clean air" situations. These results are also in keeping with the data of Smith (1974) who found the amount of carbon monoxide at street level to be about 3 times greater in the city core than in the suburbs. Such data indicate the major contribution made by the automobile of both polycyclic aromatic hydrocarbons and carbon monoxide to the atmosphere at street level.

The conclusions of this study of atmospheric carcinogens and other polycyclic aromatic hydrocarbons in the Calgary atmosphere are as follows:

(1) Calgary's atmosphere contains small but significant amounts of several carcinogenic hydrocarbons, the most abundant being; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and o-phenylenepyrene with lesser amounts of up to 15 other tumor initiators or tumor promotors.

(2) Ambient downtown air at street level contains at least 55 polycyclic aromatic hydrocarbons totalling about 12 ug/1,000 m^3, 15% of which consists of known carcinogens.

(3) The source of both carcinogenic and other polycyclic aromatic hydrocarbons in the Calgary atmosphere is primarily the internal combustion engine of the automobile.

(4) Downtown street level concentrations are 5 to 7 times higher than those of suburban residential areas reflecting differences in traffic density.

(5) Under average wind conditions in Calgary of 10 mph there is rapid mixing and dispersion of PAH pollutants in the downtown area so that concentrations at the third floor building level are three to four times less than at the street level.

(6) Downtown exterior workers at street level inhale about 35 ug per year of the fifty five measured aromatic compounds whereas the intake of the suburban resident is about 7 ug per year. About 70% of this is retained in the lungs to be metabolized by the enzyme defense system of the body.

(7) Downtown workers and apartment dwellers in modern sealed buildings with air intake above the third floor level are exposed to similar amounts of PAH as the suburban resident but workers or residents of older buildings likely receive exposures similar to that of the external downtown worker.

(8) Calgary's atmosphere contains generally lower amounts of PAH than the atmosphere of other major cities, however, during inversion conditions when the mixing layer is small and winds are calm much higher amounts are anticipated.

(9) Occupational exposure of some workers to carcinogens may greatly exceed that of the general population's exposure.

The most significant findings obtained during this research study were the identification of over forty polycyclic aromatic hydrocarbons and the quantitative measurement of these compounds in two composite air samples, one representative of the city core and the other of a residential area.

The polycyclic organic compound which has been most intensively studied in the urban atmosphere throughout North America has been benzo(a)pyrene. From epidemiological considerations it has been postulated that 1 ug/1,000 m^3 of BaP results in a 5% increase in the urban death rate from lung cancer (National Academy of Sciences, 1972). Using this as a basis Calgary, by comparison with other cities, has a relatively low air pollution problem. The question then arises to the significant quantities such as o-phenylenepyrene and benzo(a)anthracene or of the compounds which were present in trace quantities but are highly carcinogenic. Comparative data on the composition of PAH in the atmosphere of other cities is not presently available, therefore we have no means of comparing the relative carcinogenicity of the Calgary atmospheric pollutants. It may be expected, however, that the composition would be roughly similar to that in other cities in which the major source of these pollutants is the automobile.

V. RELATIVE COMPARISONS

A. Other Cities*

As noted by Smith (Smith, 1975), it is very difficult to compare levels of carbon monoxide pollution in different cities. As suggested in the study, and in many others, including Wright et al. (1975), Godin et al. (1972), Ramsey (1966), U.S. Environmental Protection Agency (1972), Kahn et al.(1974) and others, CO levels vary a great deal by location within the cities, by month of the year, by height above street level, and by local physiography and meteorological conditions. Therefore, all these factors must be known for CO monitoring sites before direct comparison can be made. Even then, a person may find that the conditions at a particular monitoring site are not at all typical of the city as a whole. Therefore, the best indicators of population exposure to CO are the COHb levels of that population.

In comparing COHb levels measured in several cities, the researcher must also be very careful to note the smoking habits of the sample, the time of the year in which the sampling occurred, the location of work of the people being tested, their occupations, the time of day when the samples were taken, the size of the samples being compared, and in general, how representative the population sample is of the city population as a whole.

Keeping these factors in mind, one can then compare the COHb data for Calgary with that of the two major COHb studies done in North America, Stewart et al. (1974) and Kahn et al. (1974).

The most meaningful comparison of the data from this study with data collected by Stewart and co-workers (1974) is achieved if one compares downtown data from Calgary with only other downtown areas or areas where a concentration of automobiles exists. Doing this, one finds that five cities in addition

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*This section is taken directly from Smith, 1975.

to Los Angeles, Denver, and Chicago and levels with averages higher than those of downtown Calgary; Detroit, Houston, San Francisco, New York and Washington, D.C. In addition, Salt Lake City and Anchorage had areas that equaled the average COHb levels of downtown Calgary. This type of comparison suggests that only 8 (44%) of the 18 cities or areas had lower levels of COHb than Calgary.

Yet, if Radford (1975) is correct in his criticism of Stewart's calibration techniques, then Stewart's data for COHb average 0.6% too high. This would suggest that this sample of Calgary's COHb levels for both downtown and the University of Calgary is very high in comparison to those of other cities. Only Los Angeles and Chicago would have locales with average COHb levels higher than downtown Calgary and none of the general city averages would equal the Calgary downtown average of 1.7% COHb. Furthermore, both the 8 hour average and end-work-day COHb values for even the University would exceed the general averages for 13 of the 18 cities and areas studied by Stewart and co-workers.

In summary, the above comparisons suggest that Calgary is not among the worst cities for CO pollution, such as Chicago, Denver, or Los Angeles. However, on occasion the COHb levels of the population in downtown Calgary probably do rise above the COHb levels measured in many other cities that do not have the conditions in Calgary that facilitate CO air pollution, frequent temperature inversions, cold climate, relatively high altitude, large number of automobiles, and vehicle concentrations in a downtown area congested with high rise buildings. Still, if Radford's (1975) criticism of Stewart's data is correct, then the CO pollution in Calgary is relatively more serious.

In their study of carcinogenic hydrocarbons Peak and Black noted that a comparison with scant information from other cities indicates that, on the average, exposures in Calgary are low primarily because of the lack of heavy industrial sources of emissions, however on calm days, when the mixing layer is shallow, concentrations of polycyclic aromatic hydrocarbons from the automobile source likely will reach that of industrialized cities. (Peak and Black, 1975, p. 10).

B. Air Pollution Vs. Smoking

Carcinogenic hydrocarbons, whether they be inhaled as air pollutants or as cigarette smoke, will increase the chances of the recipient contracting lung cancer. In the case of atmospheric pollutants this increase has been estimated to be 5% per 1 ug/1,100 m^3 for BaP in the atmosphere. For cigarettes the rate has been calculated at a doubling of the lung cancer death rate per pack of 20 cigarettes smoked per day. Thus it is apparent that unless some specific occupational source of carcinogens exists, cigarette smoking constitutes a far more serious hazard than air pollution (Peak and Black, 1975). Smokers in office buildings downtown averaged three times as much COHb in their blood as did nonsmokers. The expired air of the smoker, in not an a-typical situation, remained well above that of the room air and close to 3.4% COHb higher than the nonsmoker throughout the day. At the end of the day, 80% of the smokers had COHb levels greater than 5%, and 8% of the smokers in excess of 10% COHb. Thus, the smoker was actually adding to the CO load in the room air.

VI. IMPLICATIONS FOR PLANNING

From the various documents referred to throughout the previous discussion a number of general recommendations may be formulated relative to the implementation of design guidelines for buildings and areas subjected to unacceptable levels of air pollution. These recommendations are as follows:

1. Special attention be observed to seal the lower floors of new buildings to exclude traffic-generated CO;

2. Where possible, major entrances into buildings should be located such that prevailing road winds blow parallel to them, building sides which face major urban roadways should be as air-tight as possible;

3. Internal pollutant sources, such as parking garages within buildings, should be force ventilated outside the building;

4. That paving of back lanes in the downtown area be promoted as a means of reducing dust;

5. Criteria should be developed for undertaking wind impact studies for new buildings in the downtown. These would include criteria relating to the determination of new buildings requiring wind impact studies, the content of the study itself, and criteria for evaluating the study's results and implications.

6. Amendments be made to the existing Minimum Maintenance By-law to ensure that all buildings be properly and adequately sealed (eg. windows and doors) at all levels exposed to concentrations of pollutants in excess of provincial standards;

VII. CONCLUDING COMMENTS

Perhaps we find ourselves asking the same questions put forward by Tollefson in 1971:

1. How much pollution in the downtown environment are Calgarians willing to accept? With air pollution levels increasing and local conditions frequently exceeding Provincial air quality standards we find ourselves, perhaps paradoxically, attempting to increase the number of automobiles entering the downtown. At the same time, there have been substantial efforts to encourage the development of housing for the elderly in the downtown, a group which is among the most sensitive to air pollution. A crucial question then; what priorities should be assigned to those activities "creating" pollution and to those suffering because of it?

2. Should anything be done to prevent further pollution? Is the downtown's air pollution problem serious enough to give substance to policies aimed at discouraging automobile use within the downtown area or policies designed to channel new

commercial growth to locations outside of the city's centre? While present pollution levels appear tolerable to many downtown users it is clear that current levels do present a health hazard to many and, in the long run, perhaps to us all.

BIBLIOGRAPHY

1. Alberta Environment, 1974 Air Monitoring Annual Report, City of Calgary, Province of Alberta, 1975.

2. Anderson, E.W., Andelman, R.J., Strauch, J.M., Fortuin, N.J., and Knelson, John, Effect of Low-level Carbon Monoxide Exposure on Onset and Duration of Angina Pectoris; A Study of Ten Patients With Ischemic Heart Disease, Ann. Int. Med. 79: pp. 46-50, 1973.

3. Aronow, W.S., Harris, C. N. and Isbell, M.W., Rokow, S.N. and Imparato, B., Effect of Freeway Travel on Angina Pectoris, Ann. Int. Med. 77: pp. 669-676, 1972.

4. Aronow, W.S. and Isbell, M.W., Carbon Monoxide Effect on Exercise-Induced Angina Pectoris, Ann. Int. Med. 79: pp. 393-395, 1973.

5. Carnow, B.W. and Neier, P., Air Polluton and Pulmonary Cancer, Arch. of Environ. Health 27: pp. 207-218, 1973.

6. Maugh, T.H. Chemical Carcinogenesis: A Long-Neglected Field Blossoms, Science, 183, pp. 940-944, 1974.

7. Peake, Eric and Black, Karen, Carcinogenic Hydrocarbons As Pollutants in the Atmosphere of the City of Calgary, Calgary, Environmental Science Centre (Kananaskis), University of Calgary, 1975.

8. Radford, E.P., Letter to the Editor, JAMA 232: P. 457, 1975.

9. Smith, N., Guenter, C.A. and Hodgson, G., Community Exposure to Carbon Monoxide in Calgary, Alberta, Calgary, Environmental Science Centre (Kananaskis), University of Calgary, November, 1975.

10. Tollefson, E. L. Air Pollution Caused by the Automobile in Calgary, Calgary, 1971.

11. Western Research Ltd., Inventory of Air Pollution Sources and Emission the City of Calgary, 1971; prepared for Alberta Environment, January, 1973.

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January 21, 1991

Reference No. 519

Mr. Bob Mitchell
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2nd Floor, Highfield Place
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Dear Mr. Mitchell:

Enclosed is a submission by the City of Edmonton on the Clean Air Strategy for Alberta. City Council approved this submission at its regularly scheduled meeting on January 15, 1991. We are pleased that the Government of Alberta has taken the initiative to develop its strategy in cooperation with Alberta municipalities, who will be affected by the final policies adopted to protect air quality. The City of Edmonton is a major stakeholder in environmental protection and as a supplier of electrical energy to a large urban population.

The City's submission highlights basic principles and important consideration that should be included in the development of the strategy. The civic administration has been asked to report back to the Executive Committee of Council by April, 1991 on more specific plans for the City of Edmonton itself.

We understand that there will be further consultation as legislation is drafted, including a Spring 1991 workshop. City representatives appreciate the opportunity to participate in the workshops and are prepared to cooperate in the development of a cost-effective strategy.

Yours truly,

J Reimer

Jan Reimer
Mayor

JR/sbg
Enclosure
cc: Councillor Gary Browning, President, AUMA
Mr. Norm MacMurchy, A/Deputy Minister, Alberta Department of Energy
Mr. Ken Smith, A/Deputy Minister, Alberta Department of Environment

SUBMISSION OF THE CITY OF EDMONTON ON THE CLEAN AIR STRATEGY FOR ALBERTA (CASA)

January 16, 1991

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1.0 INTRODUCTION

The City of Edmonton endorses the Government of Alberta's initiative in developing and implementing the Clean Air Strategy for Alberta (CASA). CASA is an important initiative considering Edmontonians' and Albertans' commitment to protecting the environment, while developing a major sector of the economy. The three objectives of CASA are fully supported by the City of Edmonton:

- to help identify and clarify the most important issues associated with energy production and use, that need to be addressed in developing a Clean Air Strategy;

- to outline practical and achievable actions that can be taken by consumers and producers to reduce emissions;

- to develop policy and program recommendations to present to the provincial government.

The City of Edmonton's approach in replying to both the request from the Province and the Alberta Urban Municipalities Association for the City of Edmonton to participate in CASA was to develop adequate background information as a first step towards an air quality plan which affects a municipality as a stakeholder in the environmental process and as a major supplier of electrical energy to a large urban population.

A review and discussion of the air quality issue by the City Emissions Sub-Committee of the Interdepartmental Task Force was carried out by officials representative of key stakeholder departments from Edmonton Power, Office of the City Solicitor, Public Works, Transportation (Edmonton Transit and Transportation Planning), Planning and Development, Finance and Parks and Recreation. Subsequently a study towards an air quality plan for the City of Edmonton was authorized by the City of Edmonton for the Alberta Research Council to review air quality plans with particular reference to cities. The Alberta Research Council identified the key elements and analyzed data of such plans and made recommendations towards the development of an air

quality management plan for the City of Edmonton and assisted the City in the development of a coordinated response to the Province's initiative of a Clean Air Strategy for Alberta. In the discussion, materials from the City of Edmonton's response to the Green Plan and the Clean Air Strategy for Alberta Workshop One were also used.

Air quality plans have been reviewed and information summarized for consideration by the CASA task group. The plans reviewed were for the cities of Sacramento, Toronto, Winnipeg, Vancouver and Oslo and the regions of the Greater Vancouver Regional District (GVRD) and the South Coast Air Quality Management District (SCAQMD) and the Federal study on deadly releases of CFC's. From the review, one can identify the following elements as essential to the development of an air quality plan for a city: targets and goals; education and communication; an inventory of the emissions; some form of cost-benefit analysis; initiation within the city government; and Provincial/Federal cost sharing.

The air quality plans for the City of Toronto and the City of Vancouver both show an official commitment to the 20% reduction of the 1988 levels of carbon emissions into the atmosphere within their cities by the year 2005. While the City of Edmonton agrees in principle to the intent of this recommendation, there are a number of difficulties. First, the City of Edmonton does not have the provincial enabling legislation to address atmospheric environmental issues directly. Secondly, since the global warming problem is of worldwide scope, it is not meaningful for a municipality to set CO_2 emission targets within its own boundaries. This could in fact be counter-productive as shown in a subsequent section of this report. For example, Edmonton Power's gas-fired power stations in the City, which are more environmentally friendly, are currently used only after all available coal-fired plants are fully utilized because coal is far cheaper fuel than natural gas. This was discussed with Environment Canada but changes in operational sequence of the plants was not recommended because of the high extra fuel cost. Thirdly, there is a question whether the reduction is really achievable without major economic considerations and impact on development and the standard of living.

The implementation of environmental measures and strategies at the municipal level are to be coordinated with both the Federal and Provincial Government, and probably with other municipalities. This includes the development of targets, schedules, and resources. Cost and information sharing are two important areas which facilitates both development and implementation. It is important to examine ways by which information and experiences can be exchanged and funding and resources (including expertise, equipments and facilities) can be shared. It is important to investigate ways by which environmental measures can be effectively implemented through the sharing of costs, information and other resources with the Federal, Provincial and other municipal governments. The City of Edmonton recommends that, because of the national and international scope of the air quality issues, the Provincial and Federal governments should provide adequate funding to address the required environmental measures such as funding required for the phase-out of CFC's.

2.0 PRINCIPLES AND MAJOR CONSIDERATIONS

The City of Edmonton supports the following principles in the development of their recommendations:

- Solutions should work with nature, and not create other environmental problems.
- Strategy measures should be priorized on the basis of their environmental and economic effectiveness.
- Strategies should be cost-effective, and wherever possible should address several problems at once.
- Research and development of new technologies and processes should be encouraged through government and corporate purchasing policies.
- A broad range of policy instruments including market based approaches should be considered.
- Government should allow the maximum flexibility to encourage innovation in meeting goals.
- An ongoing process of discussion and education must be developed so that the public and their decision-makers know how their activities and programs affect atmospheric change.
- The public must be involved in both developing and implementing solutions.

- Since the global warming problem is of worldwide scope, it is not meaningful for a municipality to set CO_2 emission targets within its own boundaries. There is a question whether the reduction is really achievable without major economic considerations and impact on development and the standard of living.

- In anticipation of federal guidelines for the phase-out of CFC's and other ozone-depleting substances, it is desirable to examine the possible phase-out measures and obtain estimates of the costs and impacts at the municipal level with preliminary plans of implementation.

- It is important to investigate ways by which environmental measures can be effectively implemented through the sharing of costs, information and other resources with the Federal, Provincial and other municipal governments. Because of the national scope of the air quality issues, the Provincial and Federal governments should provide the leading role in the supply of adequate funding to address the required environmental measures such as funding required for the phase-out of CFC's.

- Prevention of future problems should focus on the control of new sources since the retro-fit of existing sources or previously approved plants under construction is normally much less economically effective and could involve serious penalties.

- Continued input by the stakeholders into policies or regulations for emission reductions should be required.

- Federal and provincial policy should be harmonized.

In June 1990, these principles were applied when the City of Edmonton presented a corporate response to the Green Plan. The response "expresses strong support for the Government of Canada's initiative in developing this discussion paper, and the for concept of sustainable development as described therein". The response included a number of points that are equally applicable to the CASA. The response also lists comments and concerns on the part of the City in relation to the Green Plan. The relevant points can be summarized as follows:

(a) The City proposes that the national environmental strategy provide specific recognition of municipal governments and include them as partners in planning as well as implementing strategies.

(b) There is a need for jurisdictional clarity on environmental matters to facilitate both compliance and enforcement.

(c) The City recommends that the federal strategy ensures that some of the new environmental business be located in areas suffering most economically from other new environmental regulations.

(d) There are comments on how the City can participate in the decision making initiatives, which include the emphasis on better and more scientific research, more information on the environment, increased environmental education and the development of legislation and regulation.

(e) It is important that municipalities' roles in providing the first line of response to many environmental emergencies be recognized and incorporated into the proposed national strategy.

(f) Edmonton Power, a major stakeholder for the City of Edmonton, has concurred with the public position of the Canadian Electrical Association with respect to global warming. It was noted that any radical change in power generation methods in Alberta would undermine the existing electrical generation system in the province. The

City's response also supports the development of new technologies to minimize emissions and promote district energy. Emission targets should also be established for all greenhouse gases at the national level to promote interaction among all sectors and minimize specific regional or sectoral impacts.

3.0 GENERAL ISSUES IDENTIFIED IN THE CLEAN AIR STRATEGY FOR ALBERTANS AND EDMONTONIANS

The CASA workshop held in Edmonton, September 6 to 8, 1990 identified various issues and options affecting air quality. The following discussion based on the workshop results (CASA, 1990), initiatives taken by the City of Edmonton and research carried out for the City by the Alberta Research Council examines the key points related to the general issues of air quality for Albertans and the options available.

3.1 Regarding what is clean air and how do we know when we achieve it?

3.1.1 Air Quality Standards and Targets

These are needed as well-defined goals for clean air quality. It was accepted that standards and targets should be derived from scientifically sound assessments of the impacts of gaseous emissions. While ambient standards for many air contaminants already exist, others could be required.

The CASA workshop results suggested that the existing standards and guidelines be re-evaluated and revised if needed. The Montreal Protocol, for example, was updated in the London Conference of 1990 with a tighter and more encompassing set of constraints on CFC's, Halons and other ozone-depleting substances. Re-examination of existing standards may also be necessary with technological development. These should be considered in the efforts towards an air quality plan.

It is also useful to approach certain air quality management problems from the airshed standpoint. This means that the factors affecting air quality from the surrounding areas should also be taken into account. In such cases, "target loadings" or "emission caps" for the complete airshed should be considered if appropriate.

It is important to monitor ambient air quality and major emission sources. This allows the enforcement of the standards to ensure that established goals are met. It was also suggested in the CASA workshop result that goals and standards should be responsive to new scientific information, technological advances and to changing public perceptions and attitudes.

3.1.2 Assessment of City of Toronto's The Changing Atmosphere: A Call to Action and the Initiatives Taken by the City of Edmonton

The following describes relevant initiatives taken by the City of Edmonton based on the City of Toronto models that have been examined by the City of Edmonton for addressing air quality problems. These are presented here as updated information for CASA and represent contribution from the Interdepartmental Environmental Task Force with major stakeholders' feedbacks. These are hopefully useful to CASA in coordinating and developing efforts to improve air quality. The City of Edmonton would be pleased to discuss any of these initiatives in the next workshop on air quality. The City of Edmonton has undertaken many air quality programs which are the same or similar to those recommended by the City of Toronto Special Advisory Committee on the Environment and approved by the City Council of Toronto. In other cases, the recommendations address concerns which are specific to Toronto and are not generally applicable to Edmonton. In still other instances the recommendations may be worth

pursuing in Edmonton and have been referred to the appropriate agency or department for further review.

Several initiatives were of an administration nature, such as, the gratitude expressed to the Special Advisory Committee on the Environment and have not been included in the City of Edmonton's response.

Responses to each recommendation of the Toronto committee are presented below.

(a) That City Council declared an official commitment to the 20% reduction of the 1988 levels of carbon emissions into the atmosphere within the City of Toronto by the year 2005.

While we agree in principle to the intent of this recommendation, there are a number of difficulties. First, the City of Edmonton does not have the provincial enabling legislation to address atmospheric environmental issues directly.

Secondly, since the global warming problem is of worldwide scope, it is not meaningful for a municipality to set CO_2 emission targets within its own boundaries. This could in fact be counter-productive. For example, Edmonton Power's gas-fired power stations in the City are currently used only after all available coal-fired plants are fully utilized because coal is far cheaper fuel than natural gas. One way to reduce CO_2 emissions in Alberta would be to change this and operate Edmonton Power's gas-fired plants at as high a capacity as possible. This would displace some of the much higher emitting coal-fired plants. Even though this would increase CO_2 emissions within the City, it would reduce emissions globally. This was discussed with Environment

Canada but not recommended because of the high extra cost. Thirdly, there is a question whether the reduction is really achievable without major economic considerations and impact on development and the standard of living.

(b) That City Council, adopt in principle, the recommendations contained in the report prepared by the City of Toronto's Special Advisory Committee on the Environment, dated October 30, 1989, entitled "The Changing Atmosphere: A Call to Action".

Detailed comments regarding specific recommendations are contained in this assessment. Toronto's recommendations recognize the municipality's limitations in reducing air pollution. However, the recommendations should have included a call for greater leadership and financial support from both the Provincial and Federal governments for:

- larger public transit vehicle fleets
- rapid transit systems and alternative transportation
- alternative fuel and cleaner-burning vehicles.

(c) That an Interdepartmental Coordinating Committee on the Environment be formed to coordinate Corporate response to environmental issues in the City. This Committee to respond to all issues relating to the City and the environment and report through the Committee of Heads.

The new Interdepartmental Environmental Task Force and Office for the Environment in Public Works were both established in 1990 and will provide such coordination as is necessary on matters beyond existing department responsibilities. The City of Edmonton plans to coordinate its environmental responses with other urban centres in Alberta, especially

the City of Calgary. However, it is also important to realize that Edmonton Power, although a department of the City, is also a utility having a high degree of environmental expertise, and it is important that Edmonton Power continue to have the necessary autonomy to compete effectively in the electric utility business.

(d) That a representative of Toronto Hydro serve on the Interdepartmental Coordinating Committee on the Environment and further that Toronto Hydro's offer of resources be seriously considered by the Interdepartmental Coordinating Committee and reported back to the Executive Committee.

Edmonton Power is currently represented on the Interdepartmental Environmental Task Force. The Task Force is considering inviting representatives from Alberta Environment and Alberta Energy to attend Task Force meetings from time to time to discuss issues having Provincial involvement as they arise.

(e) That the Interdepartmental Coordinating Committee on the Environment prepare bi-annual status reports and include a tabulation of all initiatives and the progress of each and include various graphs to provide City Council with an indication of the progress in reaching a 20% reduction of 1988 levels of carbon dioxide emissions by 2005.

Monitoring the effectiveness of environmental initiatives within the City would provide useful information, but not in relation to meaningless targets such as the 20% reduction. There is every indication that the public and politicians would welcome more information on our progress and the state of the environment. The need to educate has been identified

in submissions to both the Clean Air Strategy for Alberta and the City's Task Force sub-committees.

(f) That the Commissioner of Planning and Development examine possible appropriate strategies for the City of Toronto to prevent and control urban sprawl in the Metropolitan Toronto area.

The Planning and Development Department endorses this strategy, but the City of Edmonton is a growth-oriented city and the planning policies of the City departments reflect this. The City encourages growth throughout Edmonton but attempts to limit urban sprawl by several objectives and policies outlined in the draft General Municipal Plan. These are:

- To renew the physical and socio-economic environments, housing, infrastructure and community image in selected inner city residential neighbourhoods.
- To maintain, renew, or revitalize, as appropriate, the inner city communities.
- To encourage new development to be continuous with existing development.
- To ensure the orderly and efficient extension of municipal services and discourage the inappropriate use of temporary services.
- To encourage development proposals which lead toward the completion of neighbourhoods and meet the service and amenity needs of residents within a reasonable timeframe.

- To promote the development of town centres in suburbs.
- To strengthen and enrich the Downtown and maintain its importance as Edmonton's Centre.

- To develop housing in and near Downtown as an essential element in achieving a diverse Downtown.
- To preserve agricultural land management areas for agricultural use.

These objectives are implemented through specific projects such as A.M.P.L.E. and PRIDE, and through the day-to-day activities in reviewing suburban Area Structure Plans.

The inclusion of environmental issues in land use planning in Edmonton will require the form of urban development in Edmonton to change. It will also require considerations on density and development to change. Review at the moment focuses primarily on ensuring an adequate roadway access and pedestrian circulation systems for access to transit, schools, parks and neighbourhood amenities. The Interdepartmental Environmental Task Force is considering whether specific land uses and their relationship to transportation corridors and activity areas can be assessed in terms of their effect or contribution to the environment or global warming.

The computer modelling used in planning by the Transportation Department features methods of calculating air quality and emissions. Although it would be difficult to use air quality and emissions directly in performing a benefit/cost analysis, they are related to delays, the primary factor affecting this analysis.

(g) That City Council endorse the establishment of an Energy Efficiency Office, and that the establishment of an Energy Efficiency Office, with an advisory board composed of outside agencies such an Energy Probe, etc., be considered by the Interdepartmental Committee on the Environment and its consideration of energy conservation.

The City should investigate means within its control to improve energy efficiency and conservation. Any measures should also be economically efficient and address possible social and business investment consequences. Energy Management Committee staff members could coordinate City Departments work efforts through the Interdepartmental Environmental Task Force.

The City of Edmonton established an Energy Management Policy and a position to coordinate energy management in the City in 1981. Civic departments have made great strides in reducing energy consumption in civic facilities, as can be seen from the effective energy conservation activities described in the Annual Reports from the Energy Management Committee.

(h) That the Medical Officer of Health and the Commissioner of Public Works report jointly on the proposed "remote tail-pipe sensing demonstration project".

The Interdepartmental Environmental Task Force is examining this issue. There are a number of other operational issues where the City of Edmonton has taken action. As a leadership and public good gesture, the City could seek compliance for all City-owned and operated vehicles. The difficulty in establishing standards is the perceived emissions; for example, a diesel bus appears to be "dirty", however, when

viewed in terms of relative environmental impacts, one bus is equivalent to 40 cars, Edmonton Transit is keeping abreast of developments in the use of alternative fuels and technology with the possibility of introducing pilot initiatives.

Mobile Equipment Services (MES) of the Public Works Department has been investigating alternative fuels on an ongoing basis. Compressed natural gas (CNG) as an alternate transportation fuel has been studied by MES as early as the mid-1970's and throughout the 1980's. CNG represents an alternative to gasoline, both in fuel savings and reduction in emissions. However, there are certain drawbacks with CNG that have to be seriously considered, such as: on-board fuel storage and capacity; space occupied by fuel cylinders; and limited availability of refuelling facilities.

There are other alternatives to gasoline and diesel; examples are propane and methanol. MES has chosen propane or LPG as its alternative to gasoline. Liquid Petroleum Gas (LPG) shares many of CNG's positive attributes relative to health and safety considerations. It has a matured storage and distribution network system within the City and costs significantly less for conversions.

(i) That a complete study of the City's use of small vehicles (some 1,200 in number) be initiated with the following objectives in mind.

(j) A reduction in the number of such vehicles used by the City.

(k) A dramatic increase in the maintenance programmes on these vehicles.

(l) A programme which would replace high energy consumptive vehicles with low-energy consumptive vehicles.

Responses to recommendations (k) to (l) are as follows:

The City's fleet has been reduced from about 3,400 to about 2,800 units over the past eight years. All vehicle purchases are engineered and specified for tender so that the smallest or most economic (i.e. energy efficient) unit is placed in service. However, it should be noted that many City cars were eliminated from service and replaced by employees' use of their own vehicles.

Vehicle maintenance scheduling and maintenance activities are based on an economic cost model which minimizes the City's costs of ownership and operations over the life of the vehicle. Notwithstanding, all vehicles are tuned at regular intervals, during which time emissions are tested to ensure the original emission standards in effect at the date of manufacturing are met.

In addition, the civic accommodation strategy will consolidate civic offices in the downtown core around Churchill Square. This will minimize the amount of travel required by civic staff in the performance of their duties. The existence of an extensive pedway system further encourages City employees to walk to nearby destinations, rather than use a vehicle. Where sufficient demand for civic services exists, decentralized City offices for such services as Community and Family Services offices have been located on public transit routes throughout the City to minimize the travel required of the public to access City services. It should be noted that minimizing travel to the public may increase travel for City staff, and vice versa. The decision rule used to site civic services considers both cost and service to the public.

The City is reviewing other initiatives including:

- reducing the total City fleet by a percentage per year to be established over the next five years.
- converting all City fleet vehicles for use of alternative fuels by 1995.
- adopting the recommendations included in the Alberta Research Council's Report Towards An Air Quality Plan for the City of Edmonton.

(m) An automobile-trip reductions strategy which would reduce the need for the use of such vehicles.

There is a need to educate City staff on the merits of prudent use, i.e. reductions in emissions and associated cost-savings. Options for employee travel include provision of employee transit passes, and a reduction in parking and fleet. This would require the City to examine current policies and budgets to develop a feasible and fully operational automobile-trip reductions strategy, being both environmentally aware and meeting the needs of the public.

(n) The provision of the City bicycles rather than City cars for short trips.

The Transportation Department is examining the use of the inter-office messenger service downtown by bicycle, including the use of 3-wheel bicycles (trikes) with storage baskets to hold small loads which would eliminate the use of the auto for short trips. Adequate bicycle storage facilities would be required. Severe weather may also impact the ability for full implementation of this option.

(o) That all companies in the downtown area be contacted and called upon to take steps to reduce the use of the automobile for commuting to work by their staff including senior executives and in addition that a survey be prepared for distribution within these companies which would request employees, including senior executives, to indicate the reasons why they use their cars and what would be required for them to switch from car use to either public transit, or bicycles.

The City of Edmonton has already undertaken two major projects toward realizing the objective of this recommendation: (1) the transit users study; and (2) the employee attitude survey. Information gathered from these studies has resulted in marketing programs being developed. These are now ready for implementation. Particular attention has been paid to cost effectiveness and environmental concerns.

The Interdepartmental Environmental Task Force is examining the use of free employee parking and free transit passes for employees.

The Task Force is also examining other steps which could be taken include encouraging high occupancy vehicles, staggered hours, parking reductions, increase in price for long-term parking, and reduction in parking standards.

(p) That a comprehensive energy audit programme be instituted and accelerated.

The City of Edmonton established an Energy Management Policy and a position to coordinate energy management in all City departments in 1981. Since that time, 84 separate energy

audits have been performed on City facilities in conjunction with the Energy Conservation Branch of Alberta Energy and Natural Resources. The City fully supports this Energy Audit Program and recommendations from audits will continue to be implemented. An example of current energy management conservation practices is the Environmental Services Department's testing of fine versus course bubble aeration technology at Gold Bar Wastewater Treatment Plant, which could result in reduction of power usage of up to 35%. Civic departments have made continuous progress in reducing energy consumption in civic facilities, as can be seen from the effective energy conservation activities described in the Annual Reports from the Energy Management Committee.

The City is also investigating means within its control to improve energy efficiency and conservation. The City of Edmonton is investigating means to have all groups including commercial, industrial, and institutions, which are outside the City's direct control, participate in energy audits offered by the Energy Conservation Branch of Alberta Energy and Natural Resources. Enabling legislation for required energy audits is not in place. To date the main thrust of the City has focused on public education, mainly through the Energy Awareness Week. Participants in 1990 included Public Works, Power, Parks and Recreation and the Environmental Services Departments of the City with others being Alberta Energy, Chamber of Commerce, Northwestern Utilities, Public and Private Schools, the Environmental Resource Centre, Private sector financial participation was also received from Esso and the Canadian Petroleum Association. The success of Energy Awareness Week in November, 1990 prompted the Honourable Rick Orman, Minister of Energy and Natural Resources, to consider expanding the program to province-wide participation for 1991.

(q) That the City of Toronto Special Advisory Committee on the Environment be requested to develop more details on its proposal for the City of Toronto to contribute to reforestation projects in order to outline in more detail the options that would be available to the City and indicating to the Special Advisory Committee on the Environment that City Council is looking favourably at this concept and that the Special Advisory Committee on the Environment be urged to consult with Boards of Education regarding possible participation in the reforestation projects.

This could be a good public awareness program. However, it is suggested the project be confined to within the City limits; the public may not be supportive of municipal funds spent in other countries. The City could take the initiative by ensuring all City-owned property is adequately landscaped.

(r) That the Commissioner of Parks and Recreation, in consultation with the Special Advisory Committee on the Environment develop the parameters for a major shade tree planting programme which would have the effect of reducing the adverse effect of local warming and reduce the need for air-conditioning.

The City of Edmonton, through Parks and Recreation's Current and Capital Program, annually provides for the planting of 4,000 - 6,000 trees and 5,000 - 7,000 shrubs. The primary purposes of these plantings are aesthetic and screening. Such plantings help reduce micro-climatic extremes, and assist in air quality improvement. Park/boulevard trees are 15 times more effective in removing carbon dioxide from the atmosphere than their forest counterparts. The Corporate Tree Policy provides for the protection and preservation of trees on City land. Trees lost through municipal or private

activities or damages are compensated for and funds received used for further tree plantings. Community involvement in tree preservation and reforestation are encouraged through programs such as "Partners in Parks" and voluntary planting programs.

(s) That the Toronto Parking Authority and the Commissioner of Public Works report to the City Services Committee on its parking rates as they relate to the parking rates of the private sector and include a consideration of the recommendations from the Special Committee that parking rates be increased to meet those of the private sector and on the concept of utilizing the proceeds from parking revenue for the purposes of reducing the environmental consequences of automobile traffic.

The rates charged by the City at its lots are among the highest charged by any lots in the downtown area. In contrast, the City of Toronto charges are among the lowest in that city.

The City is considering a change in philosophy that would discourage long-term commuter parking, yet still meet the short-term parking needs of downtown businesses. This change in philosophy if implemented would require the restructuring of parking fees to remove the discounting associated with longer-term parking, and offer favourable pricing for short-term turnaround.

(t) That the City Cycling Committee be encouraged to bring forward ambitious recommendations for the provision of bicycle lanes and the promotion of cycling generally including winter cycling in the City of Toronto. This report should also include the description of a programme to increase bicycle parking facilities to the required levels.

A bicycle commuter's survey has been completed and is being analyzed by the Transportation Department as part of a comprehensive review of cycling in Edmonton. The Transportation Department is a member of the Cycling Education Committee which is comprised of cycling advocates and groups.

Edmonton Transit is currently undertaking a programme of installing bicycle parking facilities at LRT Stations and major transit centres (racks are currently installed at Clareview, Belvedere, Stadium, Westmount, Meadowlark and Millgate. Edmonton Transit will be presenting an amendment to the Transit Bylaw which will permit bicycles on board LRT cars during off-peak periods. Review is also underway for options to possible accommodation of bicycles on buses.

(u) That the City of Toronto consider re-running the retrofitting program known as "Operation Draftstop" and that the City, in cooperation with Toronto Hydro, consider initiating a home retrofitting program for energy efficiency in terms of home appliances and light fixtures.

Edmonton Power is currently preparing a new demand side management program to increase electricity conservation and reduce the power demand peak within the City. The program must take into account the actions of other Alberta utilities (since all electricity in the province is pooled) and the Public Utility Board rules. The draft program may also require the approval of Alberta Energy in the future according to proposed government measures.

(v) That a Toronto Atmospheric Fund be established and the Interdepartmental Committee on the Environment consider a suggestion that an initial deposit of $23,000,000 or 20% be made from the proceeds of the sale of the Langstaff and Concord Farms.

The Interdepartmental Environmental Task Force is considering a recommendation to request the Province to establish an Environmental Fund, funded by a fee to be charged on motor vehicle registration renewals and to be transferred to municipalities for environmental programs and research.

(w) That the Provincial Government be requested to introduce legislation to develop a 10% Carbon Release Surcharge (CRS) for all fuels and electricity used in the Province.

(x) That the Federal Government be requested to introduce Federal legislation to develop CRS nationally.

(y) That CRS funding be used to develop and use non-polluting energy alternatives.

(z) That CRS funding be used to finance changes to develop efficiency in the use of fossil fuels.

Responses to recommendations (w) to (z) are as follows:

A carbon tax is one of a number of financial measures under consideration by the Federal Government. Such a tax would be both non-equitable and very damaging to both the Alberta and Edmonton economies. The City of Edmonton specifically opposed this tax in the June, 1990 Green Plan Brief to the Federal Minister of the Environment. The Federal Green Plan

tabled in the House, December 11, 1990, did not contain the carbon tax.

In any situation where taxes are collected, there is always the question of the assignment of "surcharge" revenues. These funds should not be returned to general revenue but be used for the development and implementation of more efficient technology.

3.1.3 The Federal Study on Deadly Releases CFC's

The Government of Canada Standing Committee on Environment tabled a report in the House of Commons on June 12, 1990 entitled "Deadly Releases CFC's". The Committee Members reached one overpowering conclusion -- not just a consensus, but a unanimous opinion -- that ozone depletion is a threat to the continuation of life on earth and that an accelerated phaseout in the production and use of chlorofluorocarbons and related ozone-depleting substances beyond that prescribed in the Montreal Protocol of 1987 is necessary to deal with this global concern. They summarized that if all CFC's in refrigeration systems throughout the world were released, the ozone layer would probably be destroyed causing devastating impact on Earth's life forms.

The Committee addressed options for controlling the man-made chemicals that are both depleting the Earth's protective ozone layer and contributing to global warming. They concluded that a major public policy is required to phaseout the use of chlorofluorocarbons, halons, and related chlorinated solvents worldwide, and ensure that they are replaced by the least harmful substitutes possible. Another policy also deemed essential was to ensure that all of these substances in use are recovered, recycled, and ultimately destroyed.

It was recognized that these policies cannot be completely implemented immediately but stressed that time is of essence. They have made a plea to governments, industries, labour movements, universities, and scientific organizations around the world to initiate action at once which will fulfil these policies while time is still available to protect human survival.

There were 23 recommendations tabled by the Committee dealing with various aspects related to chlorofluorocarbons such as control measures, recovery, recycling and destruction, market signals, research needs, internal measures, and public education and responsibility. The most significant of the recommendations were made in relation to control measures and the accelerated phaseout of the ozone-depleting substances. Specifically, recommendations were made for the Canada Environmental Protection Act (CEPA) to regulate:

(a) A minimum 85 percent reduction in the production and consumption of all CFC's by 1995, with a complete phaseout by 1997; and

(b) A complete phaseout in the production and consumption of carbon tetrachloride and methyl chloroform by 1995, except for their use as feedstock for CFC or halon substitutes and as organic laboratory solvents.

It was also recommended that regulations be invoked under CEPA requiring a 95 percent reduction in halon production and consumption by 1993, and a complete elimination by the year 2000, except for those "essential uses" where no reasonably performing substitute is available.

The City of Edmonton has drafted, but not yet passed, a bylaw dealing with the proper disposal and recovery of CFC's as well as their emission through the use of certain products. The City strongly urged in the November, 1990 submission on the proposed Alberta Environmental Protection Legislation that the Province include CFC's and halons as "designated material". This would have the effect of including CFC's and halons in the group of products potentially regulated by the Lieutenant Governor in Council and would place these materials under the Province's jurisdiction. This would ensure uniformity in their emission, disposal, and recovery throughout the Province and, the City submits, would be more effective than a municipality by municipality solution.

The district energy project, currently under detailed review by Edmonton Power, would result in the shutdown of building air conditioning refrigeration systems. The use of CFC's in these systems would thus be discontinued.

3.1.4 Research Needs

There is need to provide research support to air quality issues, particularly in the areas of the inventories of background pollutants and the development and verification of air quality and climate models. Also, there is a requirement for support in improved/enhanced transportation technology and use of alternate fuels. Other areas of importance are impacts of global warming and deforestation, the socio-economic impacts of air quality goals and the chronic health effects of low-level exposures.

With the anticipated commissioning of many Alberta mega energy projects which are major sources of air quality problems in Alberta, advances in technology associated with all phases of the production, transportation and consumption

of energy are critical to the effectiveness in addressing the key environmental issues of air quality. The insecurity of the offshore energy supplies for both eastern Canada and United States places greater importance on the development of energy resources in Alberta. This means that research and development of various technologies are essential to reduce the uncertainties associated with the balance between environment and economy.

Also associated with research in air quality is the monitoring of air pollutants. In a recent report on regional air monitoring, the recommendation from the Public Advisory Board of the Acid Deposition Research Program (ADRP) is supported by the City of Edmonton for the Province to re-establish an air monitoring station at Fortress Mountain west of Calgary. Apparently, the Fortress Mountain station was able to detect high levels of ozone which were attributed to an influx from British Columbia and Washington. This was the first observation of the long range transport of ozone in western Canada. Monitoring is also useful in providing baseline information in various areas of the province. For example, there is concern amongst northerners that their environment is endangered by acid pollution imported from the Pacific coast. No background information is available to address their problem as there is no monitoring network established in their area to date. The City of Edmonton requests the Province to provide monitoring stations.

The City strongly supports the Province's recommendation of having a public facility such as the Alberta Environment library gather environmental information. The City submits that access to this environmental information should be readily available to all Albertans, free of charge or at a nominal rate. Discussions have been held among senior scientists from AOSTRA, Alberta Energy and the City of

Edmonton for the development of a common environmental data base.

Because of the scope of Air Quality issues, the City of Edmonton requests financial support in developing an urban air quality plan as described in the Alberta Research Council Report (December, 1990).

3.1.5 Public Acceptance

It has been observed that there is little public interest in the CASA consultation sessions so far. There is also a lack of public understanding of general issues like global warming. A recently reported opinion poll result states that 30 percent of Canadians think that global warming would be good for Canada. Such factors will certainly influence the level of public support in any environmental efforts.

Efforts should therefore be made to inform and educate the public regarding environmental issues and also the latest in scientific and regulatory developments. The public should have ready access to monitoring and compliance information and a multi-party consultation approach is needed in establishing targets and standards.

3.2 Regarding the way Albertans/Edmontonians include economic, environmental, and health considerations in decisions regarding clean air

3.2.1 Full Cost Accounting and Sustainable Solutions

It is desirable to perform detailed cost and benefit analysis of each option and to use the results in making decisions about energy and air quality. Full cost accounting means the consideration of all possible costs and benefits, including those related to the less tangible factors such

as the quality of life. The cost-benefit ratio can be used in developing a set of sustainable solutions (i.e. solutions that provide economic health without further environmental degradation). The Oslo study is an example of a city air quality plan based entirely on cost benefit analysis. A subset of 20 measures were identified to maximize the benefits of their air quality management plan. (See the section on review of city air quality plans.)

3.2.2 Corporate Responsibilities

There is a need to incorporate environmental considerations into corporate decision-making through environmental policy statements and environmental and energy audits. The concerns of business for returns from investments and their focus on short term cash flows are possible impediments to environmentally responsible choices. However, these can be overcome by government incentive and awareness programs. Possible options will be reviewed in the section of measures later in this report.

3.3 Regarding ways to help Albertans/Edmontonians make responsible choices?

3.3.1 Information and Educational Programs

It is important to inform the public about the choices for energy production and use and to communicate the risks and consequences of the various options. These programs should focus on empowering the individual to act. Programs can be organized through the partnership among government, industry, and other stakeholders and directed at providing service to different sectors of the community and different age groups.

There may also be programs that assist the public in making responsible choices. Programs such as those providing for

efficient use of transportation such as public transit); demonstration projects in communities; energy conservation incentive programs; award programs for the recognition of achievements and sponsoring group conservation projects.

3.3.2 Indicators

There is a perceived need for the use of indicators (environmental, energy efficiency and health) as a means of measuring the environment and the tendency towards attaining specific targets and goals. Some possible indicators include rush hour air quality measurements, traffic counts or energy consumption. There is a need to identify a health indicator. Other cities have used air quality indices (Vancouver) and the number of people affected by air pollutants (Oslo).

3.4 Regarding the relationship between an Alberta Strategy (and a strategy for the City of Edmonton) and other provincial, national and international strategies

3.4.1 International Protocols

The CASA workshop has identified the following initiatives regarding the national and international scope of the energy-related emission issue:

(a) The United Nations Economic Commission for Europe protocol agreeing to a 30 percent reduction in national sulphur dioxide reduction is due for renegotiation in 1994;

(b) The Canadian Council of Ministers of the Environment is developing a plan to limit nitrogen oxides and volatile organic compounds in order to meet a United Nations Economic Commission for Europe protocol which agrees to freeze nitrogen oxides emission at the 1987 level by 1994.

(c) The federal government is participating in the development of international protocols to reduce carbon dioxide and other greenhouse gases which will be reviewed in June, 1992 at the Brazil Conference on Environment and Development.

Because Alberta is a major supplier of fossil fuel, it should not carry a dispropriate share of Canada's cost on international agreements for reducing energy-related emissions.

3.4.2 National and International Cooperation

It was recognized that national and international cooperation is necessary to attain goals of emission reduction. This is to ensure fairness and equity. Furthermore, it is necessary to harmonize legislation and policies with other municipal and provincial governments and the federal government. A suggestion from the CASA workshop which is supported by the City was that cost-benefit analyses of the options should be done at the national and international level "to determine where maximum environmental benefits could be achieved per dollar spent".

3.4.3 Science and Technology

Scientific and technological development also need to be coordinated nationally and internationally. Alberta businesses should be encouraged to develop emission reducing or energy saving devices that ultimately can be introduced into the international and national markets. Edmonton may also benefit directly or indirectly from such developments.

4.0 LIST OF MEASURES FOR IMPROVING AIR QUALITY

From the analysis of the various air quality plans, one may obtain a number of measures which are under study or in the process of implementation for other cities or regions. For convenience, these are discussed under the three major categories of (a) Motor vehicles and traffic; (b) CFC's and ozone depletion; and (c) Other measures. Examples of cities or regions implementing or considering the measure are indicated in parentheses. Here, GVRD stands for the Greater Vancouver Regional District, and SCAQMD stands for the South Coast Air Quality Management District of the Los Angeles area. Note that the details of the measures may vary from place to place and the examples are not meant to be exhaustive.

The list is included as information for CASA and for consideration by the City Emissions Sub-Committee of the Interdepartmental Environmental Task Force for possible application to Edmonton. The City of Edmonton does not endorse or disapprove of any of the listed measures at this point.

Two specific projects currently under detailed evaluation by the City of Edmonton are:

a) district energy (Edmonton Power);
b) landfill gas utilization (Environmental Services and Edmonton Power).

4.1 Measures Related to Motor Vehicles and Traffic

4.1.1 Reduce peak hour trips and increase the number of people to vehicles using traffic management bylaws. The purpose is to reduce the number of single-occupant vehicles. (Vancouver, Toronto)

4.1.2 Provide preferential parking and parking pricing that favours high occupancy vehicles in city-owned lots and city streets and to require privately owned parking lots to do the same using city bylaws. (Vancouver)

4.1.3 Make bicycles a better transportation alternative by providing ample bicycle paths, parking and related facilities. (Vancouver, Toronto)

4.1.4 Achieve short-term reductions in emissions of atmospheric pollutant from motor vehicles using high occupancy vehicle facilities. (Vancouver, Toronto, SCAQMD)

4.1.5 Monitor tailpipes for excessive tailpipe emissions (Vancouver, Toronto, SCAQMD)

4.1.6 Establish a hotline for reporting vehicles with excessive tailpipe emission. (Vancouver)

4.1.7 Use road pricing to divert downtown traffic, fund public transit, bicycle facilities or other non-polluting activities. (Vancouver, Singapore, Hong Kong, Stockholm's Trafikplan '89, Holland's Smart Card)

4.1.8 Encourage opportunities for telecommunicating rather than commuting so as to reduce the need for transportation. The idea of a 24-hour city hall may help to provide information by computer access on city activities, services, hearings, etc. (Vancouver, SCAQMD)

4.1.9 Develop energy-efficient land use policies. This would include high density residential developments, the integration of work, residence and shopping in mixed use developments, decentralize commercial and community services to reduce travel distance, etc. (Vancouver)

4.1.10 Make access by proximity rather than by transportation a central focus of city planning. (Vancouver)

4.1.11 Encourage people to work at home so as to reduce the need for transportation. (Vancouver) Encourage alternate work weeks and flextime. (SCAQMD)

4.1.12 Request the province to introduce a regional carbon dioxide tax to fund transportation alternatives. (Vancouver)

4.1.13 Shift away from fossil fuel for city vehicles and improve the fuel composition of the city's vehicle fleet. Conserve energy in municipal operations. (Vancouver, SCAQMD) Explore the potential future of electric and natural gas vehicles. (Toronto, SCAQMD)

4.1.14 Emission standards for the city buses. (Oslo) Emission standard for all vehicles. (SCAQMD)

4.1.15 Ban on the idle running of engines. (Oslo)

4.1.16 Install exhaust cleaning equipment on city buses. (Oslo, SCAQMD)

4.1.17 Better road cleaning and reduce weardown of roads. (Oslo)

4.1.18 Encourage public transit. (Toronto) Encourage use of high speed rail. (SCAQMD)

4.2 Measures Related to CFC's and Ozone Depletion

4.2.1 Banning the use, sale and manufacturing of CFC's and other ozone-depleting chemicals. (Vancouver)

4.2.2 Ensure the effective control, recycling, recovery and disposal of CFC's. (Vancouver, Winnipeg)

4.2.3 Encourage the substitution of non-ozone depleting alternatives for products and processes currently in use. (Vancouver, Winnipeg)

4.2.4 Prefer alternative substances in the city's purchasing policies and contract allocation. (Winnipeg)

4.2.5 Adopt a work policy related to CFC and halon reduction for all city departments. (Winnipeg)

4.2.6 Phase out of the use of methyl chloroform and carbon tetrachloride, which are contributors to ozone depletion but not considered in the Montreal Protocol. (Winnipeg)

4.2.7 Acquire and disseminate knowledge of all matters related to ozone depleting substances. (Winnipeg)

4.2.8 Liaise with provincial and federal governments regarding laws and regulations pertaining to ozone depleting substance. (Winnipeg)

4.2.9 Monitor progress in the development of substitutes and technologies. (Winnipeg)

4.2.10 Liaise with industries and business and implement city bylaw to reduce CFC and halon emissions. (Winnipeg)

4.3 Other Measures

4.3.1 Accelerate methane gas collection by constructing a methane gas collection system. (Vancouver)

4.3.2 Monitor and evaluate progress in reducing emissions of pollutants. (Vancouver) Perform energy audit. (Toronto)

4.3.3 Encourage infrared scanning for energy leakage. (Vancouver)

4.3.4 Implement energy efficient lighting standards for buildings. (Vancouver, Toronto)

4.3.5 Request the province to set energy efficiency standards for appliances. (Vancouver, Toronto)

4.3.6 Plant and nurture city forests and trees in city parks, on city streets and private properties and to regulate the removal, damage or destruction of trees on private property in the City. (Vancouver, Toronto)

4.3.7 Reduce and recycle solid wastes and minimize the use of nondegradable, nonreturnable and nonrecyclable food and beverage packaging. Reduce the amount of household organic waste. (Vancouver, Seattle)

4.3.8 Favour companies with environmentally sound business practices for all city investments and purchasing. (Vancouver, Winnipeg)

4.3.9 Prepare for those consequences of atmospheric change for which we may already be committed. (Vancouver)

4.3.10 Advocate environmentally responsible policies and actions at all government levels. (Vancouver, Toronto)

4.3.11 Share information and projects with other cities of the world to respond to atmospheric change. (Vancouver)

4.3.12 Foster public awareness of the problems and develop public awareness of local initiatives. (Vancouver)

4.3.13 Plant trees in other parts of the world of offset part of the city's carbon emission. (Toronto)

4.3.14 Upgrade the existing district heating system to use energy-efficient cogeneration technology. (Toronto)

4.3.15 Prohibit CFC substitutes that have a strong greenhouse effect. (Toronto)

4.3.16 Disseminate energy-efficiency information to building operators, architects and developers. (Toronto)

4.3.17 Ban on burning of garden rubbish. (Oslo)

4.3.18 Request assistance from regional authority to reduce the present levels of sulphur dioxide emissions from regional sources. (Vancouver)

5.0 KEY COMPONENTS OF AIR QUALITY PLAN FOR A CITY

The City Emissions Sub-Committee of the Interdepartmental Environmental Task Force have contributed to the identification of air quality concerns for Edmonton by providing the major stakeholder feedbacks. The Alberta Research Council study ("Towards an Air Quality Plan for the City of Edmonton") has identified the following five key components (5.1 - 5.5) for an urban air quality plan, with two additional key components (5.6 and 5.7) having been identified by the City of Edmonton during the Council review process. These are under review by the Task Force as preliminary steps towards the development of an air quality plan for the City of Edmonton and will be submitted for Council consideration in Spring, 1991.

5.1 Targets and Goals

The targets and goals of an air quality plan are the quantitative guidelines for air pollutants defined by national or regional strategies. The Federal Clean Air Act (recently replaced by the Canadian Environmental Protection Act) for example, formulate three ranges of National Ambient Air Quality Objectives (NAAQO's) -- tolerable, acceptable and desirable ranges for various air pollutants. The GVRD applies these as the basis for its air quality management program. Other targets may be set by specific federal or provincial policies such as the reduction of CFC's called for in the Montreal Protocol and its update in the London Conference of June, 1990. Such targets often involve a time limit in addition to the pollution reduction guidelines. In addition, individual cities may have their own specific air quality problem and develop their own specific targets. Sacramento has examined the ground level ozone problem, while Winnipeg examines the problem of halons and CFC's. The City of Vancouver considers ozone depleting chemicals, sulphur dioxide, methane and carbon dioxide in its air quality management targets, while the main pollutants for Oslo are sulphur dioxide, nitrogen dioxide, carbon monoxide and soot. It is necessary to identify the targets and goals in the early stage of the development of an air quality management plan.

5.2 Education and Communication

The purpose of this is to foster public awareness of the problems associated with air pollution and to develop public support for various local initiatives and measures by involving the public in the decision-making process. Most individuals tends to look out for what is "mine" and without efforts to communicate and educate, many air quality measures will be perceived as infringements of an individual's freedom. It is necessary to communicate that the most important common freedom is the freedom to breathe and to show the improvements in our overall quality of life in an environmentally friendly society. Specific reference to improving public awareness can be found in the Vancouver and Winnipeg plans and the Report of the Standing Committee on Environment on "Deadly Releases CFC's".

5.3 An Inventory of the Emissions

To assist in the identification of targets and goals, it is necessary to have some indication of where the air quality problems are. This includes the collection of some basic facts and data regarding the existing air quality. Information such as the kinds of air pollutants, their major contributing sources, and the temporal and spatial distribution of various controlling factors are essential background information for a successful air quality management plan. For example, the climatology of the area is an important consideration in the GVRD and Oslo plans. The frequency of atmospheric inversions is a contributing factor to the air pollution problem in the mountainous terrain of GVRD. In Oslo, different fuel is used in their oil heating plants under inversion conditions to avoid trapping of excessive pollutants. In Ontario, where 25 percent of the electricity is generated by coal generating plants for peak hour usage, a reduction in peak hour electricity demand will greatly reduce carbon emissions. The opposite is the case in Alberta where gas is used for peaking. All this means that specific problems of air quality need to be identified through studying and monitoring, considering that individual cities have particular air quality

problems of their own. For Alberta, some of these information may be available. For example, the report results for ongoing monitoring by Alberta Environment of pollutants (1989 levels) for the City of Edmonton will be available March, 1991. An inventory of information should be performed to identify gaps.

5.4 Some Form of Cost-Benefit Analysis

The results from cost-benefit analyses can be used as an aid or criteria for the selection of appropriate measures and options to combat air quality problems. The City of Oslo selected their measures based entirely on the cost-to-benefit ratio. While the monetary costs and benefits are important, the more intangible values of health, low noise level and general quality of life should also be considered. Cost benefit analysis is very case-specific. For example, investing in improved efficiency and conservation can lead to a 10 to 20 percent drop in CO_2 emission elsewhere, whereas in Alberta, CO_2 emissions are expected to increase by more than 20 percent in the very near future. Hence, the same measures to improve efficiency and conservation may not produce the same cost-benefit ratio.

5.5 Initiation Within the City Government

The City of Edmonton can lead by applying the measures to its various departments. Most plans reviewed in this study contain strategies to improve energy efficiency and reduce pollution in facilities directly under the jurisdiction of the city. For example, improving the fuel economy of city-owned vehicles, more efficient use of vehicles, and the energy efficiency of city government buildings (Oslo, Los Angeles, Vancouver), developing policies to favour environmentally sound business practices in the city's operation, investments and purchases (Vancouver, Winnipeg). The Vancouver plan even contains a recommendation that the city takes a pro-active role, advocating environmentally responsible policies and actions at all government levels, including municipal organizations in Canada and globally.

5.6 Montreal Protocol With Respect to Chlorofluorocarbon Reduction

The Montreal Protocol and Toronto Conference set the targets and guidelines for the phasing-out of CFC's and other ozone depleting substances. The Alberta cities will probably have to respond by participating in the drive towards the phase-out. It is necessary first to examine the possible measures and obtain some idea of the cost and impacts. The economics of such measures must be considered in the overall plan. Factors such as collection and disposal facilities, the cost and benefits of substitutes and the effects of various phase-out processes must be assessed. For example, if less effective halon substitutes are to be used for fire extinguishers, what is the impact on the efficiency of our fire fighting service? The Winnipeg study may provide some basic information for such investigation.

It is recommended that in anticipation of federal guidelines for the phase-out of CFC's and other ozone-depleting substances, it is desirable to examine the possible phase-out measures and obtain estimates of the costs and impacts at the municipal level with preliminary plans of implementation.

5.7 Provincial and Federal Cost Sharing

The implementation of environmental measures and strategies at the municipal level are to be coordinated with both the Federal and Provincial governments, and probably with other municipalities. This includes the development of targets, schedules, and resources. Cost and information sharing are two important areas which facilitates both development and implementation. It is important to examine ways by which information and experiences can be exchanged and funding and resources (including expertise, equipments and facilities) can be shared.

It is important to investigate ways by which environmental measures can be effectively implemented through the sharing of costs, information and other resources with the Federal, Provincial and other municipal governments. The City of Edmonton recommends that, because of the national and international scope of the air quality issues, the Provincial and Federal governments provide adequate funding to address the required environmental measures such as funding required for the phase-out of CFC's.

6.0 ELECTRIC UTILITY INITIATIVES BY SENIOR GOVERNMENTS

6.1 Regulatory/Policy Changes

An important barrier to innovative emission reduction options is excessive uncertainty. Innovation is already inherently risky. Government policy or lack of clear policy can add substantially to this level of risk by imposing further uncertainty. The following regulatory/policy changes are recommended.

6.1.1 The regulatory approval process should be clear with regard to federal-provincial roles, free of duplication, and provide a reasonable level of certainty as to timing and closure.

6.1.2 Currently the rules regarding the treatment of Demand Side Management (DSM) investment costs are evolving on a piecemeal basis. It is recommended that government move expeditiously to address this issue in consultation with the electric utilities and other key stakeholders.

6.1.3 Clear cost allocation rules are required for cogeneration projects to reduce the economic uncertainties while ensuring the equitable treatment of stakeholders:

- In the case of heat produced as the result of an industrial process being used to generate electricity, the costs should be fairly allocated between the industry and the electricity customer.

- In the case of waste heat from an electric utility generating station being used to provide usable energy, the costs should be fairly allocated between the electricity customer and the energy customer.

In both cases the rules should be such that the costs paid by the electricity customer are unaffected. In other words the electricity customer should be indifferent to the cogeneration project cost.

6.1.4 The question of recovering the cost of emission reductions beyond current regulatory requirements should be addressed in consultation with the electric utilities and other key stakeholders. Lack of rules will discourage a flexible and cost-effective approach.

6.1.5 Environmental approvals to construct should reassure investors by guaranteeing that the terms and conditions will remain unchanged for some reasonable period of time. Approval conditions with a guaranteed finite life will also be necessary if an emissions trading approach is contemplated.

6.2 Incentives

6.2.1 Where new source performance standards are considered, the appropriate means of managing future electric plant emissions, these standards should be based on marketable energy output and not energy input. This would provide an incentive to maximize plant energy efficiency.

6.2.2 An immediate incentive should be given to companies to invest in ventures now which reduce emissions beyond their legal requirements. This incentive could be easily established by recognizing all such emission reductions since 1990 as banked credits against future emission standards, local airshed constraints permitting.

CLEAN AIR STRATEGY FOR ALBERTA

A PRESENTATION BY THE CITY OF CALGARY

1990 DECEMBER 5

INTRODUCTION:

Mr. Chairman and guests. The City of Calgary is pleased to present our views on the need for improved air quality in this city and on the Clean Air Strategy for Alberta. The preparation of the Clean Air Strategy is a noteworthy accomplishment and Mayor Al Duerr and members of City Council would like to compliment the Government of Alberta for taking this initiative.

PRESENTATION:

CALGARY'S CITY COUNCIL IS SERIOUSLY CONCERNED ABOUT THE DECLINING AIR QUALITY WITHIN THIS PROVINCE, PARTICULARLY WITHIN THE CITY OF CALGARY. WE ARE VERY PLEASED THAT THE PROVINCIAL GOVERNMENT HAS UNDERTAKEN THESE PUBLIC MEETINGS.

CITY COUNCIL AGREES IN PRINCIPLE THAT ENERGY-RELATED EXHAUST EMISSIONS, WHETHER FROM AUTOMOBILES OR INDUSTRIAL PROCESSING, POSE A POTENTIAL ENVIRONMENTAL HEALTH RISK FOR ALBERTANS; AND, WE LIKEWISE AGREE THAT THE ISSUE OF 'CLEAN AIR' IS A COMPLEX SCIENTIFIC AND GLOBAL MATTER THAT IS INTRICATELY INTERWOVEN INTO ALL ASPECTS OF OUR SOCIETY. ONE DOESN'T HAVE TO LOOK FAR IN THIS CITY TO REALIZE THAT THE FOUNDATION OF OUR ECONOMY IS THE ENERGY INDUSTRY. YET, WE ALSO RECOGNIZE THAT THE AIR WE BREATH AND ITS EFFECTS ON OUR HEALTH MUST BE A GREATER CONCERN AND PRIORITY TO

US, AS A SOCIETY, THAN THE ECONOMIC GAINS ACHIEVED BY CONTINUING TO CONSUME OUR FOSSIL FUEL RESOURCES (ON THE SCALE WE DO) TO MEET EVER INCREASING ENERGY DEMANDS. WE MUST WEIGH HUMAN HEALTH AND ENVIRONMENTAL CONSIDERATIONS IN RELATION TO ECONOMIC CONSIDERATIONS. OUR SOCIETY IS QUICKLY REALIZING THAT OUR SMALL AND RATHER FRAGILE WORLD CAN WITHSTAND ONLY A CERTAIN AMOUNT OF SUSTAINED ENVIRONMENTAL ABUSE. I WOULD SUGGEST, MR. CHAIRMAN, THAT THE TIME FOR ALBERTANS AND CALGARIANS TO ACT IS NOW.

THE CITY OF CALGARY DOES SUPPORT THE PURPOSE AND OBJECTIVES OF THE CLEAN AIR STRATEGY FOR ALBERTA, AND WE WANT TO WORK AS A PARTNER WITH THE PROVINCIAL GOVERNMENT TO IMPLEMENT IT. WE ENDORSE, IN PRINCIPLE, THE NATIONAL AND INTERNATIONAL COMMITMENTS MADE FOR EMISSION STANDARDS OF CARBON DIOXIDE, SULPHUR DIOXIDE, NITROGEN OXIDES, VOLATILE ORGANIC COMPOUNDS AND CHLOROFLUOROCARBONS. WE FULLY RECOGNIZE THAT

CONSUMERS AND THE ENERGY INDUSTRY IN THIS PROVINCE, AS THE LARGEST PRODUCER OF FOSSIL FUEL ENERGY IN CANADA, WILL BE IMPACTED TO A SIGNIFICANT DEGREE. THE ENERGY INDUSTRY, AND THE CONSUMERS OF THESE RESOURCES, MUST RECOGNIZE THE IMPACT WE ARE MAKING. MAYBE WE MUST WORK HARDER AT DEVELOPING BETTER TECHNOLOGY SO THAT EMISSIONS WILL BE CLEANER AND WE WILL SEE AN IMPROVEMENT IN THE AIR WE BREATH. YES, ALBERTA IS ONLY ONE SMALL PART OF THE WORLD'S AIR POLLUTION PROBLEM; BUT, IF A START IS NOT MADE SOMEWHERE, THEN HOW DO WE SOLVE OUR WORLD-SCALE PROBLEMS?

THIS PUBLIC MEETING IS AN OPPORTUNITY TO NOT ONLY PROMOTE THE CLEAN AIR STRATEGY FOR ALBERTA, BUT ALSO FOR THE CITY OF CALGARY TO HIGHLIGHT THE ACTIONS THAT WE, AS A CORPORATION, ARE UNDERTAKING TO ILLUSTRATE THAT WE ARE SERIOUS ABOUT OUR COMMITMENT TO CLEAN UP CALGARY'S AIR. A RECENT PUBLIC OPINION SURVEY INDICATES THAT CALGARIANS, ON THE WHOLE, PLACE A HIGH

VALUE ON PROTECTING THIS CITY'S AIR QUALITY. COUNCIL HAS HEARD THIS MESSAGE AND HAS ACTED WITH A NUMBER OF INITIATIVES TO BEGIN THE SLOW PROCESS OF REDUCING HARMFUL CHEMICAL EMISSIONS INTO OUR ATMOSPHERE. SEVERAL EXAMPLES OF RECENTLY INITIATED AIR QUALITY ENHANCEMENT PROJECTS IN CALGARY ARE:

THE AIR IMPROVEMENT RESOLUTION (AIR CALGARY) PROGRAM, WHICH ENCOURAGES MOTORISTS TO LEAVE THEIR VEHICLES AT HOME ONE IN EVERY 10 WORK DAYS, AND INSTEAD USE AN ALTERNATE MEANS OF TRANSPORTATION TO WORK INCLUDING CAR POOLING, TRANSIT, BICYCLING, WALKING, ETC. THE IDEA IS TO REDUCE THE NUMBER OF VEHICLES ON THE ROAD.

CALGARY TRANSIT IS WORKING ON IMPROVEMENTS TO PUBLIC TRANSIT FOR THE PURPOSE OF ENCOURAGING GREATER RIDERSHIP, RESULTING IN FEWER VEHICLES ON THE ROAD, PARTICULARLY DURING RUSH HOURS. CALGARY

TRANSIT IS MONITORING ALTERNATE ENERGY PILOT PROJECTS FOR BUSES WITH A VIEW TO IMPLEMENTING PROVEN TECHNOLOGIES AT THE EARLIEST PRACTICAL DATE.

THE CITY IS ENCOURAGING CONSUMERS AND BUSINESSES TO REDUCE THE USE OF PRODUCTS CONTAINING OR MANUFACTURED WITH THE USE OF HARMFUL PRODUCTS, SUCH AS CFC'S AND HALONS; AND, TO BE GENERALLY MORE CAUTIOUS AND RESPONSIBLE WITH ENVIRONMENTAL HARMFUL OR HAZARDOUS GASEOUS MATERIALS, SUCH AS CARBON DIOXIDE.

THE CITY IS PREPARING A BYLAW TO CONTROL CFC/HALON STORAGE, HANDLING, VENTING AND ACCIDENTAL ESCAPES PRIMARILY TO REDUCE AND REGULATE THE AMOUNT OF THESE MAN-MADE PRODUCTS ENTERING THE ATMOSPHERE.

THE CITY ENCOURAGES TECHNOLOGICAL ADVANCES WHICH WILL REDUCE VEHICLE AND INDUSTRIAL EXHAUST EMISSIONS, AND ENSURES GREATER HEALTH, PERSONAL SAFETY AND SECURITY AT LOCATIONS SUCH AS SOUR GAS WELLHEADS; AND, TECHNOLOGY WHICH WILL LEAD TO FEWER NATURAL AND ACCIDENTAL ESCAPES OF HARMFUL VAPOURS INTO THE ATMOSPHERE.

THE CITY HAS AN ENERGY CONSERVATION PROGRAM FOR BUILDINGS AND PLANTS THAT IT OPERATES AND EXPENDS FUNDING ANNUALLY TO RETROFIT FOR ENERGY SAVINGS. NEW FACILITIES ARE DESIGNED WITH ENERGY CONSERVATION IN MIND.

THE CITY IS SETTING AN EXAMPLE BY CONVERTING AN EVER INCREASING NUMBER OF ITS POLICE CAR AND OTHER LIGHT FLEET VEHICLES TO PROPANE OPERATION; THE CITY IS ALSO INVESTIGATING ALTERNATIVE FUELS,

INCLUDING NATURAL GAS AND METHANOL, FOR OTHER VEHICLES IN THE CITY'S FLEET.

CALGARY TRANSIT PROMOTES USE OF PUBLIC TRANSIT BY PROCLAIMING A TRANSIT AWARENESS WEEK. THE CITY ENCOURAGES PROVINCIAL ASSISTANCE WITH TRANSIT OPERATING EXPENDITURES THROUGH INCREASED GRANTS AND APPLAUDS THE CONTINUED PROVINCIAL SUPPORT THROUGH THE GRANT STRUCTURE FOR CAPITAL EXPENDITURES.

THE TRANSPORTATION DEPARTMENT'S TRAFFIC OPERATIONS DIVISION OPERATES A TRAFFIC SIGNAL LIGHT PROGRESSION PROGRAM TO MOVE VEHICLES THROUGH THE BUSY CORE AREA MORE EFFICIENTLY.

THE CITY HAS ESTABLISHED AN ENVIRONMENTAL OFFICE AS A DIVISION OF THE ENGINEERING AND ENVIRONMENTAL SERVICE DEPARTMENT TO COORDINATE THE CITY'S

INVOLVEMENT IN, AND TO COMMENT ON, MATTERS RELATING TO THE ENVIRONMENT, INCLUDING AIR QUALITY ISSUES.

THESE ARE BUT A FEW OF THE INITIATIVES THE CITY OF CALGARY IS UNDERTAKING AS A PROACTIVE MEASURE TO IMPROVE THE CITY'S AIR. THE CITY OF CALGARY INTENDS TO CONTINUE TO BE PROACTIVE IN IMPLEMENTING INITIATIVES WHICH WILL HAVE POSITIVE EFFECTS ON OUR AIR QUALITY IN THE FUTURE.

AN IMPACT ON THE AIR QUALITY IN THIS PROVINCE WILL BE FELT IN TIME, ONCE RESIDENTS BEGIN TO ACCEPT THAT THERE IS A NEED TO CHANGE THEIR BUSINESS PRACTICES, DRIVING AND LIFESTYLE HABITS. THE CITY'S PART IN THE CLEAN AIR STRATEGY FOR ALBERTA IS MINOR, AT LEAST IN A GLOBAL SENSE, BUT ON A LOCAL SCALE WE ARE CONFIDENT THAT CALGARIANS WHO LIKE A CHALLENGE WILL RISE TO THE OCCASION. CALGARIANS' CONTRIBUTION TOWARD CLEANING UP

OUR AIR WILL BE MADE VOLUNTARILY AND WITH ONLY MODEST ADJUSTMENTS OR RESTRUCTURING TO OUR LIFESTYLES. WE WILL HAVE TO VOLUNTARILY REDUCE VEHICLE USAGE TO ESSENTIAL TRAVEL; WE WILL HAVE TO CONTROL HARMFUL EMISSIONS MORE STRICTLY; AND, WE WILL NEED TO CAPITALIZE ON ALTERNATE MODES OF TRANSPORTATION - WHETHER THAT BE PUBLIC TRANSIT, CAR POOLING, WALKING OR CYCLING. CALGARIANS MUST BE WILLING TO MAKE CONCESSIONS; AND, TO TAKE CHARGE OF OUR LOCAL ENVIRONMENTAL PROBLEMS SO THAT OUR COMMUNITY AS A WHOLE WILL BE EXPOSED TO FEWER AIR POLLUTING AND ATMOSPHERE-ALTERING EMISSIONS.

SUMMARY

In summary, the Government of Alberta's Clean Air Strategy is a positive move toward setting and meeting fair and reasonable air emission standards set for carbon dioxide, sulphur oxides, nitrogen oxides, volatile organic compounds and methane. Calgarians, for the most part, acknowledge we have a world-wide air quality crisis and most are prepared to voluntarily make measurable - possibly even significant - changes and sacrifices to their lifestyles and to the way they conduct business.

Thank you, Mr. Chairman, for this opportunity to show support for the Clean Air Strategy for Alberta. We have a long way to go, so lets ~~BEGIN~~ CONTINUE the journey together.

1990 December 03

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bureau de
l'information publique

February 13, 1991

Mr. Myron Kanik
Deputy Minister
Room 228, Legislative Building
Edmonton, Alberta
T5K 2B6

Dear Mr. Kanik:

The pulp and paper industry has prepared and is making public its statement on a matter of major environmental importance, namely, global climate change. The document, A Statement by the Pulp and Paper Industry: Global Climate Change, is enclosed for your information.

Global climate change is an international problem requiring international solutions. The ongoing scientific and political process working towards a multinational agreement is important, and should lead to the kinds of worldwide focus and effects necessary to address the problem.

The forest sector is a major industrial component of the Canadian economy and consequently a large energy user. In the pulp and paper industry, conservation and conversion to biomass fuels have significantly reduced purchased energy requirements per tonne of product. Continued voluntary conservation programs will further improve efficiency. At this time, approximately 75 percent of the industry's fuel is derived from wood waste. The carbon dioxide emitted from this source is more than balanced by forest renewal and growth.

The forest itself is a "reservoir" for carbon as are lumber in use and paper products in use and being recycled. The industry believes that, overall, the forest sector is a net growing reservoir of carbon. Further conservation, intensive forestry and recycling will enlarge this reservoir and help reduce atmospheric carbon dioxide.

I hope you find the statement informative and useful in policy deliberations on the matter of global climate change.

Yours truly,

Howard Hart

Howard Hart
President

A STATEMENT
BY THE PULP AND PAPER INDUSTRY

ENVIRONMENT

GLOBAL CLIMATE CHANGE

VIEWPOINT

Increases in atmospheric concentrations of greenhouse gases above pre-industrial levels are well documented. Various human activities are the sources of these increases. Temperatures appear to be increasing at the earth's surface. Some scientists suggest this is caused by increased atmospheric greenhouse gas concentrations. Projections of the rate and the pattern of these changes are not estimated with much confidence.

Global climate change is an international issue which requires cooperation among nations to achieve solutions; unilateral actions will not solve it. The pulp and paper industry supports the international scientific and political process, now well underway, which will lead to conventions among governments. The industry will support actions to address the problem in the area of energy conservation and carbon reservoir enhancement in forests and forest products.

The pulp and paper industry believes that global climate change could have important consequences to the natural environment and to society. Actions must be taken to reduce the risk of damage to the environment and to natural resources. Overall, the forest products industry — its resource, its manufacturing processes, its products in use and in recycle — can contribute to reducing the risk of damage.

The Canadian forest industry is a large and important sector of the economy, producing products which directly or indirectly provide employment for one-tenth of the nation. It is also an emitter of carbon dioxide. However, in pulp and paper manufacturing, more than 75 percent of that carbon dioxide is emitted from the use of renewable biomass fuel which comes from trees. This biomass fuel provides an increasing portion of the industry's energy requirements. Unlike biomass fuels, the use of fossil fuels results in a net addition of carbon dioxide to the atmosphere. Biomass carbon dioxide, on the other hand, is part of the natural cycle of the forest and the atmosphere.

The pulp and paper industry believes that carbon dioxide emissions must be limited, carbon reservoirs must be expanded, uncertainties in the science must be reduced, and the means to adapt to change must be developed. The industry remains committed to voluntary energy conservation efforts. More intensive forestry and the establishment of new forests can expand carbon storage. Also, forest products such as lumber in permanent structures and paper in recycle are long-term carbon storehouses.

REDUCING EMISSIONS – A CONSERVATION STRATEGY

Strategies to limit or reduce greenhouse gas emissions will only be successful if they are implemented on an international scale. Emission-limiting targets and strategies must be based on an evaluation of risk and impact.

Programs to control increases in man-made greenhouse gas concentrations must consider sources, carbon cycles and sinks. All energy sources should be available for use, providing their real economic, environmental and social costs are considered. Emissions from biomass fuels should be accounted for separately from fossil fuels. There are, no doubt, efficiencies which should be pursued in energy derived from biomass fuels. However, if these fuels come from sustained yield forests, the carbon dioxide emitted from their use is recycled in forest growth.

Prepared and issued by:

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Energy conservation is an important part of limiting greenhouse gas emissions. The pulp and paper industry reaffirms its commitment to a voluntary national energy conservation program aimed at improvements in transportation and manufacturing processes that further reduce fossil fuel usage through improved energy efficiency, cogeneration and conversion to biomass fuels.

In collaboration with governments, the industry will promote research, development and technology transfer efforts to improve energy efficiency. Research coordination and cooperation at international levels are needed.

CARBON RESERVOIRS – FORESTS AND FOREST PRODUCTS

Forests and forest products are storehouses of carbon. Increasing the amount of carbon stored in these reservoirs will help reduce atmospheric concentrations of carbon dioxide.

Vigorously growing, healthy forests absorb large volumes of carbon dioxide through photosynthesis. Sound forest management will ensure those healthy forests. Intensification of forest management and afforestation of marginal agricultural lands will increase annual growth rates, and expand the carbon reservoir. Governments and industry must develop and promote the use of forest management and silvicultural practices that will maintain or enhance the carbon sink capacity of industrial forests and forest soils.

Intensifying forest protection measures to combat fires, disease and insect infestations will help ensure a healthy forest. Canadian forest fire control technology is world class and has had great success in reducing damage. Its further development and increased use must remain a high priority. This technology is an important contribution that Canada can make to resource protection throughout the world.

The pulp and paper industry is making a substantial commitment to and investment in facilities to recycle its products. This will result in reductions of paper in landfills and incinerators, and create a larger store of carbon in use. Solid wood products used in permanent structures also provide long-term storage of wood and carbon.

Trees in towns and cities — the urban forest — make an important contribution to energy conservation by protecting homes and other buildings from the extremes of heat and cold. Building this urban forest offers us all an opportunity to reduce energy use.

REDUCING UNCERTAINTIES

Although there is substantial agreement among scientists on many aspects of climate change, there remain important unknowns which make predictions uncertain.

A cooperative, coordinated, international research program is urgently needed; decisions about future actions aimed at mitigation of and adaptations to climate change will only be as good as the information upon which they are based. More investigation must be done on emission levels, chemistry, and atmospheric composition, as well as environmental monitoring for possible effects. There are serious deficits in climatic data and there is the need for continued improvement of general circulation models used to predict climate change.

IN SUMMARY

The pulp and paper industry supports an international effort to understand and address the subject of global climate change. Reducing scientific uncertainties is a high priority. Energy conservation, fuel substitution, intensive stewardship of the renewable forest resource, recycling pulp and paper products, and the use of solid wood products are important components of an effective global strategy.

FIGURE 1

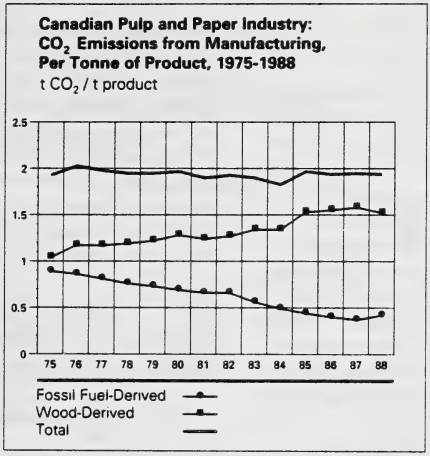


FIGURE 2

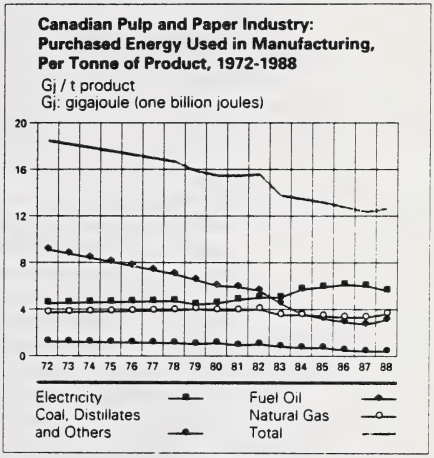
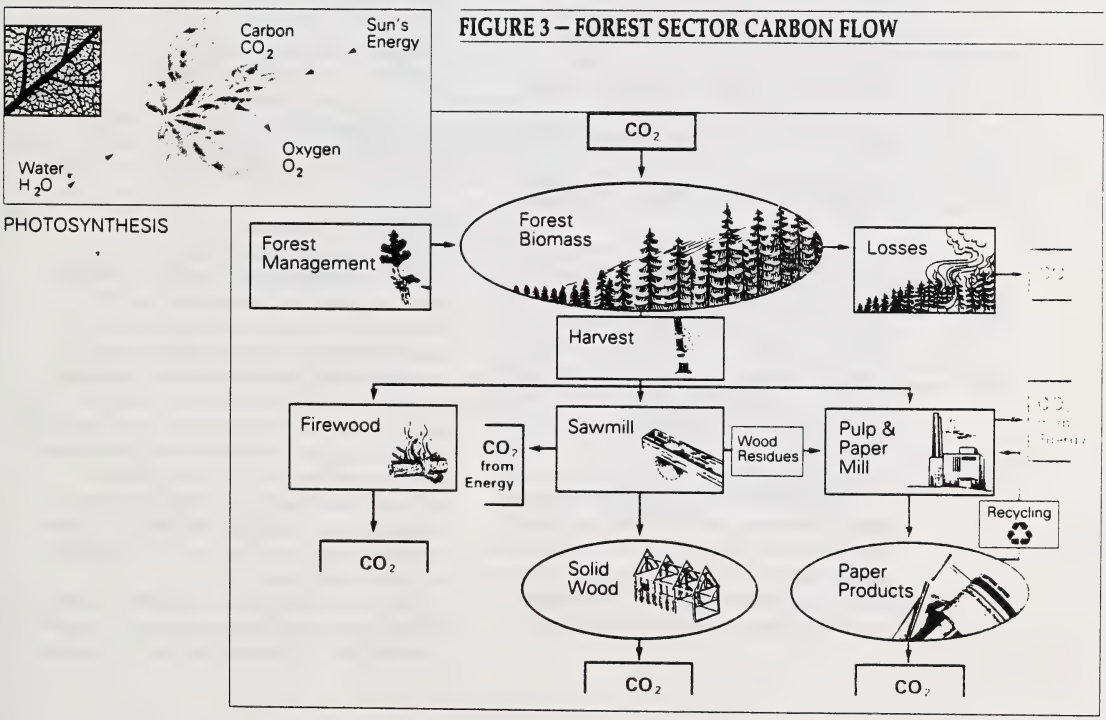


FIGURE 3 – FOREST SECTOR CARBON FLOW



The forest ecosystem withdraws carbon dioxide from the atmosphere through the process of photosynthesis, storing the carbon in the plants, leaves, and the soil. The storage of carbon in forest ecosystems and forest products is an effective means of controlling carbon dioxide emissions. The oval symbol represents the forest sector carbon reservoirs.

GLOBAL CLIMATE CHANGE AND THE FOREST SECTOR: A DISCUSSION

INTRODUCTION

The increase in the concentration of carbon dioxide and other 'greenhouse' gases in the atmosphere, and their potential impact on global climate, are currently subjects of extensive scientific and political discussion internationally. The pulp and paper industry is participating in efforts to reduce uncertainty, to improve understanding, and to define appropriate strategies and actions to mitigate potential problems.

If, as some scientists predict, significant climate change occurs, there will be a major impact on society as a whole. The forest sector, which is dependent on climatic and soil conditions, could be subject to major changes in species distribution, in growth rate, and in susceptibility to insects, disease and fire.

Unlike acid rain, which has an impact at the regional level, climate change is a truly global issue. Because of this global nature, the issue is being addressed quickly by the scientific community and by international organizations such as the World Meteorological Organization and United Nations Environmental Program under their Intergovernmental Panel on Climate Change (IPCC).

WHAT IS THE GREENHOUSE EFFECT?

The glass of a greenhouse allows sunlight to stream in freely but prevents heat from escaping, mainly by trapping the warm air inside the greenhouse. In much the same way, carbon dioxide and other greenhouse gases allow the short wavelength sunlight to pass through the atmosphere and reach the earth's surface. Some longer wavelength radiant heat emitted by the earth is trapped by the greenhouse gases so that less long-wave radiation escapes to space. The result is that heat is trapped in the lower portion of the atmosphere.

The greenhouse effect is a natural phenomenon which has kept and continues to keep the average temperature of the Earth at 15°C, 33°C warmer than it would otherwise be. It is this natural greenhouse effect which makes life on earth possible. But emissions resulting from human activities have increased the atmospheric concentration of greenhouse gases: carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs) - (see Table 1). Circumstantial evidence has led scientists to believe that these increases will enhance the greenhouse effect, and could result in an additional warming of the earth's surface. It is also estimated that the concentration of water vapour, also a greenhouse gas, will increase in response to global warming, and will enhance this phenomenon.

TABLE 1 – CONCENTRATIONS OF GREENHOUSE GASES AFFECTED BY HUMAN ACTIVITIES

	Carbon dioxide	Methane	Nitrous Oxide	CFC-11	CFC-12
Atmospheric concentration	ppb	ppb	ppb	ppb	ppb
Pre-industrial (1750-1800)	280,000	800	288	0	0
Present day (1990)	353,000	1,720	310	0.280	0.484
Current rate of change per year	1,800	15	0.8	0.0095	0.017
Current rate of change (%)	0.5	0.9	0.25	4.0	4.0

Reference: IPCC, 1990
ppb: parts per billion by volume

Since the industrial revolution, deforestation and the combustion of fossil fuels have led to a 26% increase of carbon dioxide concentration in the atmosphere. Methane concentration has more than doubled because of rice production, cattle rearing, coal mining, and ventilation of natural gas. Fossil fuel combustion may have also contributed to the increased methane concentration through chemical reactions in the atmosphere that reduce the rate of removal of methane. Chlorofluorcarbons, which were not present in the atmosphere before their invention in the 1930s, are used as aerosol propellants, solvents, refrigerants and foam blowing agents.

Various greenhouse gases have different climatic impacts depending on their emission rate, the amount of time they stay in the atmosphere, and their radiative

efficiency. Radiative efficiency is defined as the efficiency of a gas to absorb and re-emit long-wave radiation, compared with carbon dioxide (see Table 2). Based on relative radiative efficiency, the increase of all greenhouse gases due to human activities since pre-industrial times is equivalent to an increase of carbon dioxide of about 50 percent.

TABLE 2 – COMPARISON OF VARIOUS GREENHOUSE GASES

	Carbon dioxide	Methane	Nitrous Oxide	CFC-11	CFC-12
Current emissions Mt/yr	16,000 to 29,000	135 to 395	16 to 28	0.330	0.440
Radiative efficiency relative to CO_2	1	70	160	4,700	6,200
Lifetime (yrs)	40 to ?	7-10	150	75	110

Reference: Environment Canada, 1990
Mt: Mega metric tonnes or million tonnes

COMPUTER MODELS

General atmospheric circulation models have been used to provide estimates of climatic changes caused by emissions of greenhouse gases. These models predict that, with current trends and rates of emissions of greenhouse gases, we will experience an increase of global mean temperatures during the next century. Many uncertainties exist around the rate and extent of climate predictions. The role of clouds, oceans and polar ice sheets in relation to climate must be clarified. Each of these elements could influence the magnitude, the pattern and the timing of climate change. Furthermore, it is very difficult to predict possible impacts at the regional level because the degree of confidence in predictions of regional climate change is even lower than for global temperature change.

Global warming, if it occurs, will be accompanied by changes in precipitation levels and water supply patterns, and shifts in vegetation zones. These changes and the potential increase of sea level could modify demographic distribution and impact trade patterns. For the forest ecosystem, physical stresses, susceptibility to and damage by insects and diseases, as well as fire damage, may increase. Timber production could increase or decrease, depending on the availability, of water and nutrients and the forests' capacity to adapt to changes.

THE CANADIAN FOREST SECTOR AND THE CARBON CYCLE

The forest sector releases carbon into the air through its manufacturing processes and transportation activities. Canada emits two percent of the world's carbon dioxide. The Canadian pulp and paper industry is a significant carbon dioxide producer: its manufacturing processes account for almost 10 percent of the country's total domestic energy use. However, more than 75 percent of the pulp and paper industry's carbon dioxide emissions come from renewable biomass-derived fuel sources (Figure 1) that would eventually decay and produce carbon dioxide in any case. Industry has a long-standing commitment and record of fossil fuel use reduction per tonne of production. Figure 2 shows that, through various energy conservation programs and fuel substitution, the industry has reduced fossil fuel usage, per tonne of production, by 50 percent over the past 15 years.

As shown in Figure 3, the forest ecosystem withdraws carbon dioxide from the atmosphere through a process called photosynthesis, storing the carbon in the plant's biomass. Some biomass, annual plants and leaves, for example, represent short-term storage; the remaining carbon is sequestered in the woody tissues and soil for long periods.

Certain natural processes and forestry activities such as harvesting, slash burning, wildfire, peatland drainage, and natural decay, release carbon into the atmosphere.

Other forestry activities replenish the forest biomass carbon reservoir. These same activities could be used to enhance and expand the reservoirs to help offset emissions from fossil fuel consumption. They include: increasing growth of forests through intensive silviculture; afforesting treeless areas; improving the protection of the forest; and reforesting areas immediately after harvest.

Attempts are currently underway to quantify the forest sector carbon flow. Results to date have shown that overall the forest sector is storing slightly more carbon than it is releasing. The total carbon reservoir is growing.

Many suggest planting trees as a way to offset the increase of carbon dioxide emissions. Assuming a conservative growth rate of four cubic metres of merchantable wood per hectare per year, it is estimated that each hectare of plantations will sequester 2.2 tonnes of carbon per year, or the equivalent of the annual carbon dioxide emissions of 1.4 automobiles.

The forest sector helps to store carbon and to reduce emissions of carbon dioxide by producing various forest products like lumber, which may last for decades or centuries before it decays or is burned.

Recycling of forest products is gaining in popularity in North America. This trend also helps to increase the forest products carbon reservoir.

In construction, the substitution of energy-intensive materials with wood products decreases the energy requirements and thereby reduces carbon dioxide emissions.

RESEARCH NEEDS

Human-induced climate change could have consequences for the world's social, economic and natural systems, but there are substantial scientific uncertainties over the existence of global warming, its magnitude, and its rate of change.

More research is needed to reduce the uncertainties. Improvement of general circulation models used for prediction should be a high priority. Roles of polar ice sheets, oceans and clouds should be clarified.

Establishment of national and international monitoring networks should be accelerated to monitor climate and biosphere responses to change. Data standardization and quality assurance are also important considerations.

Forecasting responses to different climatic changes for various components of the biosphere should be studied. These include responses by forest stands and species distribution. Ways and means of mitigating potential impacts, especially the value of forests and forest management in the global carbon cycle, should also be investigated.

Sources and sinks of greenhouse gases should be better understood. Greenhouse gas budgets should be developed for various sectors.

REFERENCES

Environment Canada, 1990. CO2 Climate Report. No. 90-01.

Intergovernmental Panel on Climate Change, 1990. The IPCC Scientific Assessment. Cambridge University Press, Cambridge U.K. 365 p.

Additional copies of this document are available, in French or in English, from:

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January 1991

THE COAL ASSOCIATION OF CANADA

March 4, 1991

Clean Air Strategy for Alberta
Bag One, Mail Room
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Dear Sir:

RE: CLEAN AIR STRATEGY FOR ALBERTA
COAL ASSOCIATION OF CANADA RESPONSE

The Alberta Coal Industry Senior Executive Committee of the Coal Association of Canada hereby submits its position paper on the air quality issues that are being addressed by the Ministers of Energy and Environment.

As stakeholders, we trust our views and concerns as discussed in the enclosed paper will be taken into account in the formulation of policies and actions of the government.

Also enclosed is a copy of the Coal Association of Canada's position paper on atmospheric change and potential global warming.

Yours truly,

THE COAL ASSOCIATION OF CANADA

P.J. Scott, Chairman
Alberta Coal Industry Senior Executive Committee

PJS:cap

cc: Mr. N. MacMurchy, Assistant Deputy Minister, Alberta Energy
Mr. K.R. Smith, Assistant Deputy Minister, Alberta Environment

Suite 502, 205 Ninth Avenue S.E., Calgary, Alberta T2G 0R3 Telephone: (403) 262-1544, Fax: (403) 265-7604

A SUBMISSION TO

THE CLEAN AIR STRATEGY FOR ALBERTA

by

THE COAL ASSOCIATION OF CANADA

February, 1991.

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INTRODUCTION

The Coal Association of Canada (CAC) welcomes the opportunity to contribute to the Clean Air Strategy for Alberta (CASA). The CAC represents coal producers and utility companies that rely on the combustion of coal for the generation of electrical energy. Specifically, the stakeholders represented by this submission are: Fording Coal Ltd., Luscar Ltd., Manalta Coal Ltd., Smoky River Coal Ltd., Alberta Power Ltd., Edmonton Power Ltd., and TransAlta Utilities Corp.

Coal development activities include coal mining, coal storage and transport, and power generation, all of which are regulated in part through licences issued under the Clean Air Act. The coal industry, therefore, has a direct interest in the CASA since this initiative has the potential to affect the extraction and use of Alberta's most abundant energy resource and to affect ultimately the prosperity of Albertans. *As a stakeholder in the CASA, the CAC supports a thorough analysis of air quality issues as a basis for prudent policy and regulation making.* The CAC has been a partner with government in the development of reclamation and water quality standards, and we similarly offer our commitment to the development of a fair and effective CASA.

PERSPECTIVE

Alberta has the natural advantage of huge economically retrievable coal reserves. *Alberta's coal reserves contain over twice as much energy potential as that of the Province's oil, natural gas, and oil sands reserves combined. As a result of the abundance of accessible, low-cost, low-sulphur coal, about 85 to 90 per cent of all electricity in Alberta is produced by coal-fired generating stations.* These natural advantages have made coal the fuel of choice for electrical energy production in Alberta. Provincial policy supports the use of coal-fired plants for base load electricity requirements.

Albertans can look to coal as an energy source that will be available far into the future. By any reasonable scenario of energy demand into the foreseeable future, coal will be able to provide electrical energy for up to hundreds of years. Unlike other fossil fuel sources, resource sustainability is not an issue for coal in Alberta.

Alberta's eleven major coal mines produce some 30 million tonnes of coal annually. Alberta benefits in numerous ways by having a vibrant coal mining industry: low-cost supply of electricity; direct employment of over 2,400 people in the mining industry plus over 5,400 people at utilities; contributions to municipal taxes, royalties and lease payments, and provincial income tax.

Alberta's coal industry is a highly regulated industry. The "Coal Development Policy for Alberta" governs virtually every aspect of coal development in Alberta. The coal industry is regulated mainly under The Coal Conservation Act, The Clean Water Act, the Clean Air Act and The Land Surface Conservation and Reclamation Act. These Acts and associated regulations govern coal mining operations from construction through to abandonment by the use of approvals, permits, licences, annual reports, and frequent government inspections. In addition, coal development approvals are closely linked with the approval process for electrical generating stations. This process includes the Energy Resources Conservation Board, Alberta Environment regulatory agencies, the Public Utilities Board and the Electricity Marketing Board. In many instances, the costs of ever-increasing regulations can be absorbed but Alberta's metallurgical coal mines must compete on world markets, and increased cost of regulations threaten the viability of some mines.

AIR QUALITY ISSUES

Most of the coal mines in Alberta are surface mining operations, located primarily in rural areas. Since these mines are essentially earth-moving operations, the production of dust and air borne coal fines is unavoidable but their cumulative impact is similar to that of the agricultural tillage and fallowing operations that typify the settings of all prairie strip mines. The major mitigative measures applied to control dust at coal mines are road watering and establishment of vegetative cover on disturbed sites as part of ongoing reclamation operations.

The coal industry's reliance on fuel driven heavy equipment such as draglines, coal haulers and dozers requires industry to be constantly vigilant of improvements in mechanical technology and equipment fleet utilization. Our producing mines can all point to significant improvements in efficiencies that translate into ongoing improvements in the emissions of fuel driven equipment.

The handling, washing and drying of coal at coal preparation plants and the transport of coal to mine-mouth generating stations or to export markets present possibilities for the generation of coal dust. Historical coal drying and loading operations were routinely associated with dust that was once an accepted part of coal development in mining communities. Modern coal facilities are evolving into enclosed structures that limit external release of coal dust. Open stockpiles of coal are minimized or, where necessary, coated with water or dust retardants. Similarly, train cars loaded with coal are sprayed with latex to limit the loss of coal or production of dust. Coal mine facility sites are licensed under The Clean Air Act which requires regular monitoring and reporting of air quality.

Coal-fired generating stations produce emissions of fly ash, sulphur dioxide, oxides of nitrogen, carbon dioxide and water vapour. As indicated in the

submission of the Electric Utility Planning Council to the CASA, electrical utilities have made major strides in reducing emissions from coal-fired power plants to meet provincial and federal standards.

The coal producing members of the CAC share the air quality concerns and issues that confront its electrical utility customers that rely on the combustion of coal to meet the Province's electrical needs. One issue, in particular, that has been receiving the attention of the popular press is the presumed relationship between carbon dioxide and climate change or global warming. *The issue of global warming is one example of where public policy and air quality standards have the potential to be influenced by a relationship that remains to be scientifically substantiated. The CAC urges the CASA to evaluate critically the air quality issues and the environmental and economic implications of any policy formulated in the absence of scientific consensus.* The Alberta Acid Deposition Research Program (AADRP) is an example of research that provides a basis for arriving at a rational strategy for one aspect of air quality management in Alberta.

The following portions of this brief highlight the CAC's view of current air quality issues and recommended approaches to a Clean Air Strategy. The coal industry has consistently demonstrated that its technology can be brought into line with environmental requirements as defined through public, government and industry consensus and scientific information. Examples of this include The Land Surface Conservation Act and the present Environmental Impact Assessment Guidelines which were formulated initially using the coal industry as a test case. The coal industry participated in the development of reclamation technology and set the standard for environmental impact assessment in Alberta. The coal industry continues to cooperate in the process of regulatory reform, through the establishment of the Coal Coordinating Committee by Alberta Environment and the Energy Resources Conservation Board. We trust that this same spirit of consultation and consensus will prevail in the formulation of the CASA.

ISSUE RESOLUTION

The CAC is committed to environmental protection. The coal industry recognizes that commitment requires action, including research and cooperative efforts with government.

Research

Coal industry involvement in joint research programs with government, such as the Mountain-Foothills Reclamation Research Program (MFRRP) and the Plains Coal Reclamation Research Program (PCRRP), provide examples of how industry and government can respond to environmental uncertainties. In the early 1970s, the depth

of subsoil replacement on reclaimed plains coal mining areas proved to be a contentious issue. At the time, a prevailing opinion by some regulators favoured the requirement for a substantially deeper subsoil replacement depth than what industry thought was reasonable. This situation was not unlike that of the global warming controversy in which a reasoned opinion is that environmental controls should err on the side of caution.

The issue of subsoil depth was resolved through the establishment of PCRRP. Both regulators and industry accepted the findings of the Program, which resulted in the subsoil requirement being revised downwards substantially. Coal mine reclamation now achieves a standard of land capability at least comparable to that existing before mining. The revision of the subsoil requirement, based on sound information, lowered the costs of mining and reclamation which are ultimately borne by the citizens of Alberta.

Land use issues in the past were resolved through joint government-industry cooperation in reclamation research which provided the basis for practical reclamation technology founded on sound scientific information. Similarly, several air quality issues face the coal industry, some founded on uncertain scientific information. We suggest, therefore, that the same approach should be applied to the resolution of air quality issues.

The CAC recognizes that commitment to air quality must be supported by action in areas where there are concerns. Most recently, members of the CAC have initiated the development of an Advanced Integrated Gasification Combined Cycle (AIGCC) demonstration project. This project includes the participation of the federal and western provincial governments. The demonstration plant will combine coal gasification with gas and steam turbines to produce the cleanest, coal based electricity possible. AIGCC has the potential to provide carbon dioxide recovery, 99% removal of sulphur, 75% reduction in NOx emissions, increased efficiency and related benefits such as reduced requirements for land and water. *The CAC looks to AIGCC as a commitment to the future to develop new technologies that will enhance our capability to respond to new environmental challenges.*

Consensus

The definition and establishment of meaningful environmental standards can be achieved through commitment to environmental protection by both government and industry. Until recently, water quality standards specified in Clean Water Act licences issued to coal mines in the mountain and foothills region of Alberta presented problems for both regulators and mine operators in terms of achieving compliance. Both parties formed a committee to formulate meaningful discharge standards for water control structures at minesites. The criteria for new water quality standards included satisfying the conditions of being biologically

meaningful, scientifically based and technically achievable. In part, this process drew on the results of a hydrological study commissioned through MFRRP. To date, a draft licence has been formulated with preliminary agreement by all parties. *The CAC looks forward to continuing its cooperative approach with government in developing meaningful and scientifically-based air quality standards.*

National and International Perspectives

The CAC urges coordination with national policy making in the area of air quality. Initiatives such as the Federal NOx/VOC Management Plan and the setting of carbon dioxide targets must be supported by international agreements. Canada and Alberta run the risk of developing air quality strategies that have little global impact, yet place its industries at an economic disadvantage. Developing countries will continue to rely on coal for the generation of electricity using coal combustion technology considerably less efficient than that of Canada's and on a scale of two orders of magnitude higher in terms of tonnage of coal burned.

In terms of relative impact, Canada and Alberta can achieve greater impact through the transfer of clean coal technology and international agreement than through unilateral action only. The CAC is willing to commit manpower to such technology transfer; coordination remains to be provided by the Federal and Provincial governments in this respect. *Unilateral federal action unsupported by a coordinated provincial strategies will only act to prejudice Alberta's ability to grow on its strengths; that is, its natural resources such as coal.*

RECOMMENDATIONS

The CAC considers the CASA to be a positive and important initiative. We therefore offer the following suggestions that reflect our expectations of the CASA.

Clear Definitions of Issues

An effective air quality strategy for Alberta must be founded on clear definitions of issues. In the absence of consensus amongst the scientific community, actions directed toward taking appropriate measures must be justifiable. *Action on issues such as global warming must be supported by scientific information collected and analyzed by independent scientists.*

Environmental and Economic Implications

The Clean Air Strategy was established to "outline practical and achievable actions that can be taken ... to reduce emissions". The opportunity for managing

air emissions will not fully realized until the government sets clear objectives and targets based upon the opinions and technical expertise of all stakeholders in Alberta.

These targets must be set with a thorough understanding of the environmental and economic implications to this province. The support required from the public and industry to specific objectives and targets will only come when we have an analysis of the incentives and costs associated with the management of emissions.

Constructive Solutions

The CASA should address those areas of Alberta where significant air quality problems are known to occur. The Alberta Acid Deposition Research Program report indicated that acid gases are not, in general, harming the Alberta environment, although some areas of the province could be susceptible to acid deposition. This suggests that the mechanism of applying sulphur dioxide/NOx caps should anticipate zone limits for such emissions, not necessarily province-wide limits. *The CASA should incorporate flexible regional solutions depending on the capacity of the environment to assimilate emissions.*

International and national air quality initiatives and protocols will clearly influence our decisions in Alberta. The CASA initiatives directed only at the management of industrial air emissions within Alberta are likely to have little relative impact on global air quality. Nevertheless, such initiatives cannot fail to appreciate the global context; the CASA must therefore assess how it can exert influence on those jurisdictions and countries that are less circumspect about air quality. One possibility suggested by the CAC is technology transfer.

The Alberta effort on air quality should be supported by the federal government to ensure that the CASA initiatives are not undertaken in isolation in the global context. *Similarly, the government of Alberta should ensure that federal initiatives seeking global agreement on air quality are based on sound scientific information and reflect regional environmental and economic priorities within Canada.*

Partnerships with all Stakeholders

The CAC urges the Alberta government to strengthen ties between the province and the federal government in identifying common goals, defining the issues, and developing solutions and actions where warranted. The CAC is concerned that the CASA may overlap with federal initiatives, which could result in unnecessary regulatory duplication or uncertainty as in the case of the present environmental assessment review controversy. *We therefore urge the Alberta government to take the lead role and seek harmony between provincial and federal air quality regulations.*

The CAC recommends that the CASA build on the working relationships that CAC has developed with Alberta Environment in the matters of regulatory reform, reclamation approaches, and water quality standards, as highlighted earlier in this submission. *The CAC is committed to the development of enlightened environmental policy and legislation based on scientifically defendable information and consensus with all stakeholders.*

Regulatory Framework

The current regulatory framework for air quality management in Alberta rests with the provincial Clean Air Act. We endorse the retention of this Act within the broad enabling legislation of the proposed Environmental Protection and Enhancement Act.

The setting of emission targets can be very costly and inefficient without the flexibility for the operator to choose the appropriate technological and economical tools. *The CAC favours the use of decentralized approaches to implement new targets and standards;* in our view, market based instruments such as tradeable permits and tax incentives will be more efficient than command and control strategies. *The regulatory framework for the CASA should promote a flexible approach.*

CLOSING

The coal industry has direct interest in the Clean Air Strategy for Alberta. The CAC is committed to contributing to a meaningful and efficient CASA and recognizes that commitment to air quality must be supported by action. We look forward to continuing our cooperative approach with the provincial government in the interests of achieving a sustainable environment and economy.

CANADIAN COAL INDUSTRY'S POSITION ON ATMOSPHERIC CHANGE AND POTENTIAL GLOBAL WARMING

The constitution of The Coal Association of Canada, written in 1973, specifically cites "environmental concerns" as an area towards which the Association is to direct its attention and efforts. In the intervening years the Canadian coal industry has demonstrated its concern for the environment, its ability to mitigate impacts and to operate within publicly acceptable environmental guidelines. Efforts have focused on issues of water quality and use, land use, air quality, industrial health and reclamation.

Today, the coal industry has a heightened concern for the environment due in particular to the issues of potential global warming and climate change. The growing level of public concern with these issues is creating pressure on politicians to provide leadership and guidance to the country.

As an important contributor to Canada's energy needs, the coal industry needs to share with the public and governments factual information relevant to our industry and its role as a source of energy. We do not have final answers to all of the questions but we can contribute to improving the understanding of the role of our industry and hence improve the quality of decisions Canadians make.

Furthermore, the Canadian coal industry is itself committed to take specific actions directed at important environmental concerns. These actions will fall generally into the categories of science and technology, education, and policy making.

Technology

The Canadian coal industry will:

1. Continue to improve its own efficiencies to reduce emissions and to consume less energy in the production and use of coal, a continuation of the behaviour referred to earlier.

2. Continue applied research and development to achieve further efficiency gains in the production, transportation and use of coal.

3. Examine and adopt where practical, the alternative options of reducing vehicle and equipment emissions through higher efficiency gains by electrification and fuel substitution.

4. Promote the use of higher quality coals and more efficient coal combustion technologies in developing countries and Eastern Europe.

5. Invest in the development and deployment of high quality, low impact coal combustion and processing technologies. An example is the joint industry/government feasibility study of integrated gasification combined cycle power generation technology to reduce emissions and increase efficiencies.

6. Seek further applications for waste heat recovery and use (for example district heating, greenhouses, fish farming, etc.), and strive to find economic uses for all by-products of the coal cycle.

7. Seek applications for higher efficiency energy use from coal by promoting cogeneration projects; e.g., to produce steam for electrical power generation and other industrial applications including district heating.

8. Promote purchasing of energy efficient production equipment by the coal industry.

9. Develop measurements of coal industry emissions and monitor the performance of the industry on a regular basis.

Communication and Education

1. As a major segment of the Canadian economy both domestically and through exports, the coal industry will act to inform the public and the policy decision makers of the social and economic effects of potential environmental policy and regulatory decisions on our industry and participate in the ongoing consultation process among government, industry, labour and Non Government Organizations.

2. The Coal Association of Canada will launch a major information campaign designed to update and inform decision makers and educators on the role of coal in the energy mix. In the process the Association will adopt strategies to more effectively communicate to these and other stakeholders.

3. The Coal Association of Canada will establish an external advisory panel to the Association on environmental issues.

4. The Coal Association of Canada will provide data and personnel to assist the federal government in promoting Canadian technology abroad to reduce the global impacts of coal use.

5. Encourage government to include industry and Non Government Organizations in the negotiation of international treaties and make competent coal industry personnel available.

Science

The coal industry agrees that the potential impacts of significant climate change require that response actions be taken. Given the considerable level of uncertainty with respect to timing, magnitude and global distribution of possible change, these response actions must be environmentally and economically responsible. The coal industry believes that much can be done to moderate emissions through energy conservation measures and improvements in efficiencies in energy supply.

Policy Making - Recommendations to Governments

The government's goal is "to make Canada the industrial world's most environmentally friendly country" which we assume to mean providing leadership in achieving sustainable development. Leadership may be established by aggressively seeking to understand the implications of atmospheric change, by promoting efficiency and conservation, and by carefully reasoned decision making which integrates economics and environmental issues on the basis of practical established priorities. Canada can continue to show leadership in demonstrating an ability to develop effective processes for achieving nation-wide consensus on actions to be taken to protect the environment.

As an example, the industry recommends that before entering into any international agreements Canada ensures that it has the backing of stakeholders within Canada. We recommend the involvement of representatives of appropriate Canadian industries, labour and Non Government Organizations in ongoing international negotiations. As a country highly dependant on its international competitiveness, Canada would be wrong to sacrifice that competitiveness without a full and ongoing consultation with the affected parties.

In a similar vein, the coal industry believes that international agreements will only be as effective as the strength of each country's domestic commitment. If Canada is to demonstrate true leadership the federal government must have the backing of all environmental stakeholders. Thus, we recommend that future policies and strategies for environmental control should be developed not only on the basis of full consultation but with stakeholder consensus.

The industry strongly recommends accelerated research and technology development to improve scientific understanding of the environment and any changes that are occurring. Funding and manpower for research and development at the federal level should therefore be focused on global environmental issues.

Coal represents approximately 71% of the fossil fuel resources in Canada and a similar percentage on a worldwide basis. In view of the abundance of this resource, the coal industry recommends that Canada focus significant research on development, deployment and export of the best possible economic coal combustion technology.

The industry recommends seeking international consensus for resolving global environmental problems on the basis of specific national needs. In this way, nations such as Canada could concentrate their economic and technological resources in those areas where they can have the

greatest possible impact on the global environment. We believe that solving local problems is the most cost effective solution to improving Canada's overall environmental performance.

It is crucial to this country that Canada maintain its economic strength. Actions that weaken the Canadian economy and render it uncompetitive internationally will leave us poorly equipped to address global and national environmental challenges. The industry recommends that the federal government introduce environmental policies that reward innovation, and provide Canadian industry with the economic flexibility to seek lasting technological solutions to environmental problems. The federal and provincial governments should not be competing with each other regarding stringency of standards. Rather, the focus of their efforts should be to ensure that the appropriate standards are properly applied at the regional level, and that the federal and provincial governments work effectively together in their application.

We support further refinement of industry's environmental responsibilities in priority areas such as land reclamation, air and water quality, and wildlife protection. At the same time, we call for a clear process of legislation with appropriate stake holder input and clear governmental jurisdictions.

Governments should support the efforts of coal burning electric utilities to adopt energy conservation measures such as cogeneration, demand side management, and district heating.

It is a prerequisite that any examination of radiative gases should take into account all greenhouse gases and their full fuel cycles, because if only burner tip emissions of carbon dioxide are considered, the predicted results of mitigative measures could be seriously incorrect and overstated.

Finally, it is important to emphasize that the ultimate world reserves of hydrocarbons are finite and this is particularly so for the more economic sources of oil and gas. Our energy policies should ensure that these limited resources be consumed in the most appropriate applications and as efficiently as possible. This approach will ensure that we attain the goal of sustainable development as well as achieve our objectives of reducing greenhouse gas emissions.

Summary

The Canadian coal industry has for years demonstrated its commitment to environmental responsibility. The industry has a program of activities designed to continue our responsibility. At the same time, we believe that a cooperative, consultative approach by industry, government, labour and Non Government Organizations will yield the best possible results. We urge the governments of Canada to show leadership in this important area and we offer our cooperation.

October 1, 1990

CANADIAN PETROLEUM ASSOCIATION

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February 6, 1991

Mr. Norm MacMurchy
Assistant Deputy Minister
Alberta Department of Energy
10th Floor
9945 - 108th Street
Edmonton, Alberta
T5K 2C9

Dear Mr. MacMurchy:

RE: CPA SUBMISSION TO CASA

Please find enclosed the Canadian Petroleum Association's (CPA) submission to the Clean Air Strategy for Alberta (CASA). This document represents the collective views of our member companies and presents a number of recommendations for improving the management of Air Quality in Alberta.

CPA members have a significant interest in CASA because they represent some of Canada's largest upstream petroleum producers. As such these members are also responsible for producing many of the emissions currently being reviewed by CASA. We are, therefore, keenly interested in the development and implementation of strategies to more effectively manage air quality in Alberta.

I trust that you will find the recommendations made in this document to be useful in preparing for the CASA Summary Workshop to be held in early June, 1991. CPA plans to take an active role in this workshop and would like to participate fully in the ongoing management of air quality issues that result from this meeting.

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Mr. Norm MacMurchy
Assistant Deputy Minister
Alberta Department of Energy
RE: CPA SUBMISSION TO CASA

February 6, 1991

If you should have any questions with respect to this submission, please contact Mr. Doug Bruchet of my staff.

Yours sincerely,

Ian R. Smyth
President

CANADIAN
PETROLEUM
ASSOCIATION

CANADIAN PETROLEUM ASSOCIATION

SUBMISSION FOR THE CLEAN AIR STRATEGY FOR ALBERTA

February 8, 1991

PREFACE

The Canadian Petroleum Association submits this document to the Government of Alberta as part of the consultation process of the Clean Air Strategy for Alberta (CASA), a project jointly sponsored and managed by Alberta Energy and Alberta Environment. This document outlines the CPA's views and recommendations for improving management of air quality in Alberta.

CASA was initiated in early 1990 by Alberta's Ministers of Energy and Environment. It is aimed at encouraging public discussion on gaseous emissions that contribute to acid deposition, ozone depletion, ground-level ozone (smog) and the greenhouse effect. The objectives of CASA are:

- to help identify and clarify the issues associated with energy use and production that are most important in developing a clean air strategy
- to outline practical and achievable actions that can be taken by consumers and producers to reduce emissions
- to develop policy and program recommendations to present to the provincial government

The strategy allows for input at four stages from groups, individuals and industries that have specialized knowledge or interests in air quality issues.

CPA members are keenly interested in providing input to CASA. As some of Canada's largest upstream petroleum producers, CPA members are responsible for producing a large proportion of the emissions currently being reviewed by CASA. Association members produce approximately 80 percent of Canada's crude oil and 70 percent of its natural gas, and they conduct over 90 percent of the country's pipeline transportation of petroleum products.

PREFACE
(cont'd)

The CPA is confident the recommendations in this document will contribute significantly to the search for methods to improve current and future air quality. The association is also confident its recommendations will be assessed in detail by Alberta Energy and Alberta Environment and encourages them to contact the association for further clarification of any points.

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INTRODUCTION

This report presents the CPA's recommendations for improving air quality management in Alberta. The recommendations focus on the need to set priorities and objectives for air quality improvements and to apply effective processes to achieve these objectives. The recommendations also emphasize long-term solutions because the CPA strongly believes any plans established during the current CASA consultations, must be adaptable to meet changing needs of the future.

The CPA provides its recommendations in the form of specific action plans. The association believes this will help government and industry move quickly toward establishing effective methods of decision-making and administering air quality improvements. The consultation process is an excellent forum for establishing criteria to assess the severity of air quality problems, develop programs to suit each problem, set deadlines and assign responsibilities.

Background to CPA Recommendations

The recommendations reflect a number of CPA beliefs regarding environmental protection. These beliefs, which have resulted from member companies' involvement in numerous environmental projects, are listed below:

- environmental protection goals and measures must be well-defined and based on sound scientific information
- protection measures must be responsive to technological advancements and changes in public perceptions and attitudes
- measures must be cost-effective, addressing highest priorities first to ensure best use of limited resources

Background to CPA Recommendations

- the best available scientific knowledge must be used at all times to make decisions
- all stakeholders must participate in defining problems and measures for improvements
- governments must use regulatory approaches that are most appropriate for ensuring environmental protection. Market-based incentives to encourage activities that reduce emissions should be assessed.
- air management strategies cannot be unilateral because some problems are the result of emissions from outside Alberta
- federal and provincial legislation and policies must complement each other to avoid regulatory confusion and unnecessary costs

The CPA recently stated these beliefs in the Issues and Options Workshop in Phase One of CASA. Many other industries, groups and individuals at the workshop held the same views. The CPA has also stated these points in other documents presented to governments: the CPA's response to Environment Canada's "Framework for Discussion on the Environment" and the CPA's response to Alberta Environment's Discussion Draft of the Proposed Alberta Environmental Protection and Enhancement Legislation.

The belief that all stakeholders should be involved in decision-making is clearly conveyed in the CPA's recommendations. The CPA recommends stakeholders be involved in the development of criteria for making decisions on air quality management and for implementing these decisions. This approach will eliminate concern about how the government assesses and uses stakeholder input during consultation. After stakeholders have had input

Background to CPA Recommendations (cont'd)

into this framework for air quality management, government can administer the program.

CPA's Environmental Program

The CPA's recommendations for air quality management stem from its long-standing involvement in environmental projects. Over many years, the association has supported research programs, prepared an environmental code of practice and guidelines for its members, and participated in cooperative projects with governments. CPA members have also consistently met or bettered government-regulated emission levels for oil industry operations.

A comprehensive description of the CPA's environmental program, including future activities, is in Appendix A. The CPA's Environmental Code of Practice, developed in 1988, is presented in Appendix B.

RECOMMENDATIONS

The CPA presents seven specific recommendations that form an action plan for improving air quality management in Alberta. The first three recommendations provide methods for defining objectives for air quality management in Alberta; the next four recommendations provide the processes for attaining those objectives.

The recommendations are as follows:

1. Define Air Quality Issues
2. Set Priorities for Issues
3. Establish Objectives and Targets
4. Adopt a Zone-Targeted Approach to Air Quality Management
5. Use Appropriate Regulatory Instruments
6. Provide Effective Consultative Decision-Making
7. Coordinate Air Quality Research and Data Management

1. Define Air Quality Issues

Identify Current and Future Air Quality Issues

The first step to setting air quality management objectives for Alberta should be to have the stakeholders clearly identify current and future air quality issues and the nature and severity of their environmental impacts. In doing this, only the best available knowledge must be used. As discussed in the Issues and Options Workshop, the best available

1. Define Air Quality Issues (cont'd)

Identify Current and Future Air Quality Issues (cont'd)

information should be obtained from all sources, including government, industry, universities, researchers and other stakeholders. The Acid Deposition Research Program (ADRP), a recently released study on the environmental effects of sulphur dioxide emissions, is a very useful reference as are the long-term biomonitoring studies conducted by the Northern Forest Research Centre near sour gas plants in West Central Alberta.

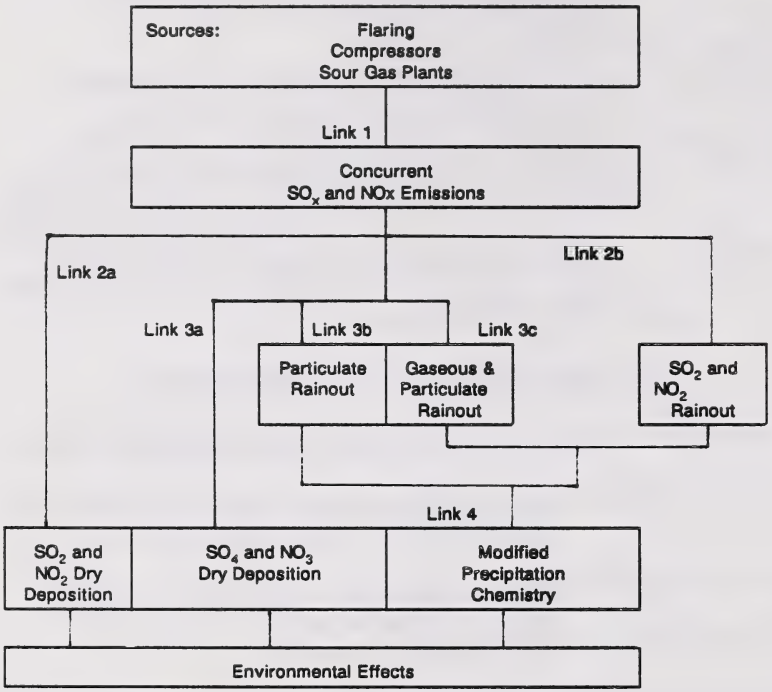
Define All Aspects of Air Quality Issues

In defining an air quality issue, stakeholders should:

- describe emission types, amounts and dispersion characteristics (i.e., zones of potential impact)
- assess ecological fates and effects of emissions (Figure 1 shows an example of how fates and effects could be analyzed.)
- assess the probability and significance of the effects of emissions on health, socio-economics and the biophysical environment
- analyze trends in factors that affect air quality, such as those listed below, to enable prediction of air quality in the future:
  - population
  - climatology
  - energy production and use
  - economic development activity

  Trends should be examined on an international, national, regional and local basis.

CAUSE AND EFFECT ANALYSIS OF ACID DEPOSITION



Linkages

1. Point source emissions from the Project A, Project B and other provincial/extra-provincial sources will result in concurrent SO_x and NOx emissions.

2a. Gaseous SO_2 and NO_2 emissions will be directly absorbed (dry deposition) by surface features. The degree of absorption will depend on atmospheric stability and the surface characteristics of the receiving substance.

2b. Gaseous SO_2 and NO_2 emissions will be removed by rainout processes.

3a. Particulate SO_4 and NO_3 forms will be absorbed (dry deposition) by surface features, depending on atmospheric stability and the surface characteristics of the receiving substance.

3b. Particulate compounds will be entrained in the cloud formation process and act as condensation nuclei (rainout).

3c. Interception of the emission plumes by precipitation can result in the removal (washout) of gaseous and particulate compounds.

4. Precipitation chemistry will be modified as a result of particulate rainout, gaseous and particulate washout, and SO_2 and NO_2 rainout.

Source: Modified from OSLO Project Draft Environmental Impact Assessment Summary Report from Workshop II: Development and Validation of Impact Hypotheses.

FIGURE 1

2. Set Priorities for Issues

Optimize Use of Limited Resources (cont'd)

After the stakeholders have identified air quality issues, they must set priorities for the issues to ensure limited resources (human, financial, institutional and natural resources) are used most effectively.

Stakeholders must be involved in this ranking of air quality issues. This is because they will be affected by corrective measures and therefore should participate in determining what issues are most important.

Make Priority Setting an Objective and Ongoing

The CPA also recommends stakeholders set priorities for issues objectively, using pre-determined criteria and best available scientific information. Criteria should relate to:

- human health
- biophysical impacts
- economic impacts
- urgency

Priorities should be constantly evaluated using the best available knowledge at the time, to ensure the ranking is still pertinent.

3. Establish Objectives and Targets

Assess Costs and Benefits of Various Target Emission Levels

After stakeholders have objectively set priorities for air quality concerns, they should determine acceptable and practical target emission levels for the emissions of concern. To do this, various levels should be evaluated for their:

- environmental effects
- effects on human health
- costs

Through this objective assessment stakeholders can select emission levels that result in the optimum balance between costs and benefits.

The target emission levels should be focused on current or potential air quality problems.

The CPA recommends the use of tools such as a scenario matrix, as shown in Figure 2, for determining optimum target emission levels. The scenario matrix shows:

- the various target levels applied to zones of potential impact
- regulatory or technological options for restricting emissions to those levels
- ambient concentrations, deposition levels or both that result from various target emissions
- the effects of target emission levels on the environment and socio-economics

EMISSION SCENARIO MATRIX

Emission	Year	Current or Future Emission Level (t/d)	Target Emission Level (t/d)	Regulatory or Technological Control Options	Ambient Conc. and/or Deposition Levels	Impacts: Environmental	Impacts: Socio-economic	Costs
SO_2	1990							
	1995							
	2000							
NO_x	1990							
	1995							
	2000							
CO_2	1990							
	1995							
	2000							
VOCs	1990							
	1995							
	2000							

FIGURE 2

3. Establish Objectives and Targets (cont'd)

Assess Costs and Benefits of Various Target Emission Levels (cont'd)

- the costs of restricting emissions to those levels

Risks associated with uncertainty will also have to be added to this information when decisions are being made.

In addition to providing an objective analysis of air pollutants, the scenario matrix has the following benefits:

- it shows how changes in emissions of one gas affect the emissions of others
- it shows gaps in information
- it demonstrates the need to set priorities for actions because of the broad implications of changes

This scenario matrix is different from methods used currently, which focus mainly on emission rates rather than effects of total emission levels from all sources on the environment and socio-economics.

4. Adopt a Zone-Targeted Approach to Air Quality Management

Ensure Government Regulatory Structure Focuses on Problem Areas

The CPA recommends stakeholders and government establish air quality management zones which spatially define pollutant-specific air quality problems (current or potential). Zone-targeted total emission levels would be set for each pollutant of concern.

4. Adopt a Zone-Targeted Approach to Air Quality Management (cont'd)

Ensure Government Regulatory Structure Focuses on Problem Areas (cont'd)

The levels of total emissions for the zones would be determined using the best available knowledge of the problem, as generated in the previously described scenario matrix.

Use Objective Criteria for Establishing Zones

The zones with their associated target emission levels would be based on the following information, and could be deleted or amended in response to new information:

- emission sources and volumes
- emission dispersion characteristics
- fates and ecological impacts of emissions
- risks and probabilities of all related events

Benefits of Zones

The CPA supports the use of air quality management zones because they can be designed to address differences in real or potential air quality problems. For example, zones could be established around urban centres where NOx and VOCs emissions (urban smog) might be a concern, or in an area where SO_2 is a concern because the soil or surface water is particularly sensitive to acid deposition. In some parts of the province, present air quality is not a concern and zones with further emission reductions are not required.

4. Adopt a Zone-Targeted Approach to Air Quality Management (cont'd)

Benefits of Zones (cont'd)

The zone concept ideally would not have to recognize provincial, federal or even international boundaries, making air quality management even more effective.

The zone concept also provides flexibility in responding to problems because different approaches to controlling emissions can be implemented in different zones.

5. Use Appropriate Regulatory Instruments

Consider a Combination of Regulatory Approaches

The CPA recommends the government use an innovative and flexible approach to air quality regulation. Controls could include a number of different methods: economic incentives and market-based mechanisms (i.e., permit trading), as well as the traditional command and control approach (i.e., specifying maximum allowable point source emissions for specific activities). Market-based controls to air pollution promote reductions in pollutant emissions by changing the business factors that affect decision-making within industry.

More information on market-based approaches will soon be available in the discussion paper "Market-based Approaches to Managing Air Emissions in Alberta". This work is funded by the CPA, Alberta Energy and Alberta Environment.

5. Use Appropriate Regulatory Instruments (cont'd)

Consider a Combination of Regulatory Approaches (cont'd)

The association offers to work with government to:

- identify and assess alternative approaches to controlling air pollutant emissions
- better integrate economic and environmental considerations into decision-making

6. Provide Effective Consultative Decision-Making

Obtain Stakeholder Input Over the Long Term

Throughout this report, the CPA has recommended stakeholders have input into all key decisions regarding air quality management. To ensure this happens throughout the consultation process and into the future, the CPA urges the government establish an effective way of regularly gathering input and making joint decisions.

Stakeholders should continue to be involved in defining:

- emission objectives
- desired emission targets for air pollutants
- air quality management zones
- appropriate methods for reducing emissions (e.g., regulatory instruments, monitoring requirements, etc.)
- appropriate time frames for change

6. Provide Effective Consultative Decision-Making (cont'd)

Obtain Stakeholder Input Over the Long Term (cont'd)

Stakeholders should also have input into the coordination of air quality management efforts with other provinces and countries. As air quality management problems extend beyond the province, other provinces and countries will have to be consulted.

The CPA believes stakeholder input is mandatory for two very important reasons:

- to bring to the process the benefits of stakeholders' diverse knowledge and experience
- to ensure stakeholder commitment to actions taken to manage air quality

The CPA also recommends government focus its efforts on obtaining stakeholder input on the criteria and processes for managing air quality. Once consensus has been reached on these basics, stakeholders can implement the decisions within their own operations and Alberta Environment can administer the program.

The CPA recommends government involve representatives from the public, industry and government (e.g., Energy Resources Conservation Board or Alberta Energy) in the air quality management program. This will enable consideration of economic and environmental aspects of air quality management. Economic analyses must be part of decision making.

7. Coordinate Air Quality Data Management and Research

Improve Use of Air Monitoring and Research Information

The CPA recommends the government coordinate the current efforts of air quality data management, analysis, assessment and research. At present, most air quality information is spread among a number of groups and is not being effectively used to improve air quality management. Also, little use is being made of the substantial air quality information gathered during industry monitoring.

The coordinated effort needs to produce the following results:

- new, more efficient methods of testing and monitoring air quality
- coordinated research projects
- a comprehensive information management system that includes the extensive monitoring information currently being collected, is cost-effective, and enables assessment of current and emerging regional, inter-regional and global air quality issues.

The CPA feels strongly that monitoring information must be included in the data management system to make data more useful. Currently, the primary use of monitoring information is to determine regulatory compliance. Monitoring information can be used to a much greater extent to:

- assess provincial air quality
- provide timely feedback to key stakeholders to allow them to assess progress toward meeting established goals and to assist them in making decisions

7. Coordinate Air Quality Data Management and Research (cont'd)

Improve Use of Air Monitoring and Research Information
(cont'd)

- make improvements in air quality monitoring capability
- support scientific research on key air quality issues
- develop improved dispersion models for assessment of facilities and projects
- ensure cost-effective use of resources by all stakeholders

CPA Commitment to Recommendations

The CPA's seven recommendations provide an ongoing process that will enable objective and effective management of air quality. The CPA is committed to working closely with government in using these recommendations as well as input from others involved in the CASA consultation process, to improve air quality management in Alberta.

APPENDICES

Appendix A: Summary of CPA's Environmental Program

Environmental Activities Within CPA

The CPA has a long history of environmental work. In the early 1970s the CPA started a number of the initiatives that continue to lead the way to sustainable development, not only within the upstream petroleum industry but also within other Canadian industries. The association created an environmental standing committee, and also positioned the industry to reduce accidental oil spills and better manage its containment and recovery. In 1973 the CPA also joined, as a charter member, the provincial environment minister's Alberta Petroleum Industry/Government Environmental Committee, established in 1973.

The association's environmental efforts were largely spill-related throughout the 1970s, and its initial environmental research project had oil and brine spills as its focus. The CPA is now involved in an ever-broadening variety of environmental work.

Environmental Code of Practice

In 1988 the CPA adopted an environmental code of practice for the industry. The code encourages member companies to strive for high environmental performance standards. To supplement the code, the association updated its Environmental Operating Guidelines and prepared guidelines for environmental audits and public consultation.

Operations

The CPA's Environmental Operating Guidelines for the Petroleum Industry are a compendium of legal, regulatory and technical requirements for environmentally sound oilfield practices. The 1980 publication was updated with major modifications in 1988, and it has played a large part in the broad integration of environmental management into all types of upstream petroleum industry operations.

Research

Since 1970, research projects with a total value of about $300 million have been conducted by CPA members, many through joint programs with other associations, governments, universities and countries.

The CPA presently supports a variety of research initiatives, one of which is the Task Force on Oil Spill Preparedness, committed to spending $5.5 million on research over five years. Another CPA research activity is Environmental Studies Research Funds (ESRF), which is funded entirely by petroleum company contributions (at about $1 million per year) and managed jointly with government.

In addition to funding research, CPA members provide advice to several externally funded research groups, including government groups. A notable example is the Panel on Energy Research and Development (PERD), which includes energy-related environmental research in its mandate. CPA representatives are members of several PERD technical committees and provide input on upstream petroleum industry priorities and research needs.

The CPA also has an environmental research committee with a mandate to coordinate and advise on environmental research issues, priorities and external relations.

Past environmental research initiatives by the CPA include the CPA Environmental Research Advisory Council, formed in the mid-1970s, and the Acid Deposition Research Program (ADRP). The Canadian Offshore Oilspill Research Association (COOSRA) was initiated in 1980 and funded (at approximately $1 million per year) by members of the upstream petroleum industry involved in frontier offshore exploration. A number of studies under the COOSRA program were conducted jointly with the upstream petroleum industry and governments. The

Appendix A: Summary of CPA's Environmental Program (cont'd)

Research (cont'd)	largest project involving COOSRA was the Baffin Island Oilspill Study, a 4-year, $7 million study conducted on Baffin Island. Governments and private industry in both Canada and the U.S. were involved, as well as the government of Norway.
Waste Management	In 1983, the CPA released waste disposal guidelines for the petroleum industry and fostered their implementation through industry-wide seminars. The association commissioned research studies on the disposal of oily wastes through land farming, and on the reclamation of land affected by spills. The CPA also successfully developed a special incinerator for oilspill wastes. The CPA, through its Waste Management Subcommittee, is currently revising its Waste Management Guidelines to help the upstream petroleum industry improve reduction, recycling, treatment and disposal of oil and gas wastes. The Guidelines will include details on the Workplace Hazardous Materials Information System, Transportation of Dangerous Goods Regulations, and quantitative evaluations of numerous wastes and hazardous substances.
Work Environment	Hazardous materials management in the workplace received special attention in 1988. In that year the CPA created a training package for oilfield workers and generic labels for hazardous materials.
Sulphur Handling	The CPA's Sulphur Handling Guidelines illustrate ways to handle sulphur safely, with minimal risk to the environment. They were first published in 1981, and updated in 1983.

Appendix A: Summary of CPA's Environmental Program (cont'd)

ADRP	In 1983 the CPA made a major financial commitment to a baseline study of the impact of SO_2 (sulphur dioxide) emissions and other air pollutants. The ADRP investigated the biophysical and medical effects of air emissions in Alberta. It received acclaim from scientists and scientific organizations around the world. The research teams issued their final reports in 1988.
Frontier Development	Since the early 1970s, the CPA has organized and sponsored annual conferences on environmental and socio-economic issues in the frontier regions. These conferences are in addition to the ESRF, established in 1983. During the 1980s, ESRF published 105 specialized research studies on frontier-related environmental subjects.
Public Information Activities	The association believes in public participation and consultation. The ADRP, for example, used one of the most elaborate public involvement programs ever incorporated in a major scientific research program. And one of the key provisions of the Environmental Code of Practice is that oil and gas companies acknowledge the legitimacy of people's right to know about the particulars of projects that will affect them or their environment. In keeping with that, the CPA has also developed Public Consultation Guidelines, which are finding use beyond the oil and gas industry.
Global Climate Change	In 1989, the CPA chose to improve its understanding of global climate change. An Air Issues Task Force commissioned an independent scientific review of the Intergovernmental Panel on Climate Change working-group reports. The task force is currently studying air emissions released by the industry (CO_2, NOx, CH4 and VOCs).

Appendix A: Summary of CPA's Environmental Program (cont'd)

Economic Instruments	CPA, Alberta Energy and Alberta Environment have recently commissioned a study to evaluate the feasibility of using economic instruments (e.g., permit trading, taxes, surcharges) to control pollution. The CPA will continue to advise government of its findings in this area.
Policy Statement	Companies are committed to protecting the environment and to maintaining public health and safety during all phases of operation of the petroleum industry. They do so on behalf of their shareholders and employees, and on behalf of present and future generations of Canadians.
Society Environment and Energy Development Studies Foundation	The CPA contributes funding and time to the Society Environment and Energy Development Studies Foundation (SEEDS) program. The mandate of this foundation is to prepare teachers to instruct all grade levels in energy and environmental issues and to create learning modules for students. SEEDS is governed by a board with equal representation from industry, education an the social/environmental sciences.

Appendix B: Environmental Code of Practice

Planning

Companies will assess the potential effects of their projects and will integrate protective measures into the planning process to prevent or reduce impacts upon the environment and on public health and safety.

Environment and resource use and public health and safety considerations will join economic, technological and operation evaluations as fundamental components of the planning and decision-making process. This approach will satisfy sound business principles while ensuring that planning, development and operating decisions reflect sensitivity to environmental issues and concerns.

This principle emphasizes the importance of anticipating potential positive and negative effects upon the environment, understanding the interactions and potential consequences between projects and the environment, and the necessity of taking action. To ensure that appropriate action is pursued, environmental planning will be incorporated into all aspects of project design and development.

Anticipating a project's environmental impacts and its associated effects upon public health and safety will enable companies to develop strategies which ensure that impacts and risks are managed. This process will not be limited to new projects nor applied only at the approval stage. Rather, it will be applied to all activities from initiation to decommissioning. It represents a long-term commitment to environmental protection and maintenance of public health and safety.

Consultation

Companies will provide relevant information in a timely fashion to the public and to governments with respect to corporate policies and activities and will be responsive and sensitive to community concerns.

Consultation (cont'd)

The need for and the extent of consultation depends on the location, size and nature of an operator's activities. Companies are committed to determine the need to consult early in their planning process. The consultative process will include education, information and communication.

Companies will foster the consultation process by creating the mechanisms required for allowing effective communication during the various phases of the project or activity. Responsibility for this process will be assigned to individuals who have decision-making authority. Consultation meetings with governments, communities and the public will be held early in the process to ensure that sufficient time is available to present all the relevant information, listen and respond to concerns and implement corrective action. In some circumstances, member companies will consider funding directly affected parties to provide access to necessary technical expertise and to facilitate their participation in the consultation process.

Consultation does not mean that companies will be required to divulge information which could affect their competitive position, and they must retain the right to manage all aspects of their operations.

Compliance

Companies will comply with applicable laws and regulations and will adhere to the intent of industry guidelines.

Companies will develop and participate in environmental compliance programs. These programs include environmental audits, inspection and monitoring. Environmental audits (reviews) will be systematically conducted by each company. The results of the audits will be confidential and will be the responsibility of the corporate officers. These

Compliance (cont'd)

audits will be used by the company to assess their compliance with corporate policies, government regulations and industry guidelines, and to identify deficiencies and develop programs for improvement.

Companies will implement inspection and monitoring programs to detect and minimize unanticipated incidents which may result in a state of noncompliance. If such events occur, corrective action will be taken.

Companies will cooperate with government representatives in the development of abatement programs. If a company wilfully or wantonly violates laws and regulations, member companies fully support firm enforcement of the law to protect the environment.

Industry associations will continue to serve as a vehicle for companies to cooperate in developing industry guidelines. The guidelines will periodically be reviewed and updated to ensure that they reflect the best practical technology.

Corrective Action

Environmental damage caused by company activities will be corrected in a timely and efficient manner.

If oil and gas development activities result in negative impacts on the environment, timely corrective action will be taken. Corrective action is the response to a situation or practice which will or has potential to have a negative effect on public health and safety.

In most cases, corrective action will be based upon established corporate plans and procedures or industry guidelines. The speed with which action is pursued will depend upon the potential risk

Corrective Action (cont'd)

to human health and safety and the risk of the impact increasing. If the impact is limited and controlled, specific actions may take advantage of operational circumstances, including timing to avoid seasonal constraints.

If environmental protective measures cannot reduce damages to acceptable levels, companies will make every effort to negotiate compensation agreements directly with the affected property owners.

Emergency Response

Companies will implement programs to minimize the consequences of emergency events by ensuring prompt and effective response.

The fundamental assumption underlying the emergency response principle is that all available and practical resources and skills will be brought to bear to bring an emergency under control.

While the probability of an emergency event occurring during oil and gas operations may be low, should it occur its consequences could be severe. Accordingly, prevention of such emergency events will be the industry's first priority.

Companies will develop timely and effective response plans to deal with possible emergencies. The complexity and detail of the emergency response plan will depend upon project specific factors, assessment of risk and potential consequences of an emergency incident.

The components of emergency response plans will include: an operational plan which defines decision-making authority, methods of implementation, and available resources; a communication plan which includes internal and external communications

Emergency Response (cont'd)

segments; and procedures by which the plan can be evaluated.

Research

Companies will encourage and support research relevant to improving industry's ability to protect the environment and maintain public health and safety.

Research refers to any discrete project designed to develop and assess new designs and procedures in response to current or anticipated problems and must be based on good science. Research supported by companies primarily responds to questions of "need to know" as distinct from "nice to know".

Where there is reason to believe that the environment faces damage, or there is a risk to public health and safety, companies will use research as one means to improve related designs and procedures.

Companies will cooperate in developing and implementing research with industry associations, other companies, government agencies and directly affected parties. To successfully achieve the research objectives, every effort will be made to develop a consensus on the studies to be conducted and the research methods to be employed.

The results of non-proprietary research programs will be available to the public and effectively communicated to directly affected parties.

CANADIAN WESTERN NATURAL GAS
COMPANY LIMITED

NORTHWESTERN UTILITIES LIMITED

10035 - 105 ST.
EDMONTON, ALTA.
T5J 2V6

January 15, 1991

Clean Air Strategy for Alberta
2nd Floor, Highfield Place
10010 - 106 Street
Edmonton, Alberta
T5J 3L8

Dear Sir/Madam:

**RE: SUBMISSION TO CLEAN AIR STRATEGY
BY CANADIAN WESTERN NATURAL GAS COMPANY LIMITED
AND NORTHWESTERN UTILITIES LIMITED**

THE COMPANIES

The business of Canadian Western Natural Gas Company Limited (Canadian Western) and Northwestern Utilities Limited (Northwestern) is the production, transmission and distribution of natural gas. Canadian Western has served southern Alberta since 1912, and Northwestern has served central and northern Alberta since 1923.

Today the companies provide natural gas service to more than 650,000 customers in 294 communities. Combined, we employ over 2,800 employees and have approximately 35,000 km of transmission and distribution pipelines. Revenues in 1989 amounted to over $655 million.

Throughout our history, the companies have been associated with clean air because of the clean burning nature of natural gas in comparison with other fuels. This factor resulted in our companies being environmentally conscious long before clean air became a major public issue. The companies are currently active participants in research and development of environmentally beneficial projects such as natural gas vehicles, cogeneration and turbo expanders. We have experience and expertise that will be of significant value in the further stages of environmental policy and legislation development.

INTRODUCTION

In attempting to develop a Clean Air Strategy, the government has committed itself to an enormous undertaking.

We support the efforts of the government to solicit input from the public and industry in the review of government strategies and also ultimately, in the legislation development process.

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With this input, coupled with what has been learned from other provinces and countries, we are hopeful that this effort will ultimately result in a strategy incorporating operating guidelines or legislation which will benefit every Albertan and be administered in a fair and consistent manner to all.

Obtaining the cooperation of Albertans is vital for the successful implementation of the Clean Air Strategy. Their trust must be won by the development of strategies, guidelines and legislation that incorporates the input submitted to the consultative strategy development process.

Following are our views and recommendations of what is required for the development of the Clean Air Strategy for Alberta. This information has been categorized under the headings utilized by the CASA review process.

STANDARDS AND REGULATIONS

It is the role of government, aided by the consultation process, to set standards and regulations. However, the methods used to meet or exceed such requirements should be left to industry to decide. Proposals for standards and regulations should bear substantive evidence as to the necessity of their consideration. They must be developed in a scientific manner and not include misleading recommendations.

Data bases must be established for areas of significant clean air concern. The emissions inventories done for Alberta on carbon dioxide, sulphur and nitrogen are examples of the type of information needed for developing effective strategies and policies, not only for government legislation but also for the reference of industry and other stakeholders.

When proposing new standards and regulations the government should ensure that these proposals are attainable and reasonable with respect to the impact on the economy of the province, the consideration to regional issues and the prioritization based on criticalness. Also, when proposing new standards and regulations it is vital that the methods of administering them and time frame guidelines be specified within the proposal.

All parties which may be affected by such proposed standards should be informed of the proposed changes as soon as possible so that they can provide input in the process and be better prepared for compliance requirements.

Consultation with the federal environmental authorities should be included in the process of establishing provincial standards.

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ECONOMIC INSTRUMENTS.

Government should support industries, businesses, and individuals which operate in an environmentally responsible manner.

Government initiated economic incentives or deterrents must be applied with very careful consideration, so as to achieve the intended outcome.

Companies should be allowed to include investments in energy efficiency as a business cost. For utilities, this would mean allowing such costs to be included in its rate base. This type of incentive would enable businesses to implement energy efficient, environmentally responsible measures as potential business opportunities rather than being viewed merely as a financial burden.

ENERGY EFFICIENCY AND CONSERVATION

To accurately assess the environmental efficiency of a business' or an individual's activity each must be subject to the same evaluation process. Full cost accounting, assessing the environmental impact of products and operations for the full cycle of their use, should be the basis of any evaluation.

Incentives should be offered to encourage energy efficiency audits, and the implementation of energy saving options.

Support should be given to those who are prepared to convert to less polluting fuel sources.

The government should set an example to others by ensuring energy efficiency and conservation policies are implemented for all its operations.

EDUCATION AND INFORMATION

Organizations and individuals must be made aware of how their actions affect the environment. Such knowledge is necessary if those organizations and individuals are to develop and implement effective means to reduce harmful effects on the environment.

Albertans must ultimately be able to make decisions based on adequate knowledge and understanding of the issues at hand. Environmental education and information dissemination should be enhanced by a joint effort of industry, education and the government.

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Corporations should be encouraged to educate their employees and the public through environmental programs. The government can assist in this area by determining whether information used is accurate and unbiased.

Education programs in our school systems should include environmentally responsible lifestyle courses.

In addition to the energy consumption data presently shown on appliances, a rating of appliances with respect to environmental impact considering full fuel cycle should be attempted.

A public resource centre should be established with complete and accurate information on the issues concerning the environment.

SCIENTIFIC AND TECHNOLOGICAL RESEARCH

A system should be developed to ensure information transfer is promoted and to avoid duplication of effort in research. This would enable us to direct our financial resources for research more effectively. Coordination of this undertaking should involve all levels of government.

Studies must be done to enhance our understanding of how emissions affect the atmosphere and ecosystem. Climate modelling can then be done with greater reliability to demonstrate the potential effects of implementing a regional air shed use change.

An environmental research centre of excellence should be established at one of the Alberta universities in conjunction with industrial groups and the Alberta Research Council.

The use of alternate fuels should be thoroughly studied to fully assess their fuel cycle cost.

Research should be supported in those areas which offer promising solutions to our atmospheric problems.

FUTURE DEVELOPMENT

The Clean Air Strategy for Alberta proposal only considers emissions from the production and use of energy in Alberta. The Clean Air Strategy should be expanded to consider other emission sources, such as waste disposal, agricultural practices, and industrial processes.

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CONCLUSION

It is clear that this process of strategic development is a never ending one.

We look forward to participating in the continuing development of this strategy, and in other strategic developments yet to come.

Yours very truly,

L.D. Bruce
Vice President, Marketing

LDB/kk

alberta forest products association
104 - 11710 kingsway avenue, edmonton, alberta T5G 0X5
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January 15, 1991

Clean Air Strategy for Alberta
Bag One, Mail Room, Main Floor
North Tower, Peroleum Plaza
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

To Whom It May Concern:

Attached please find our submission regarding the Clean Air Strategy for Alberta. If you require further information please do not hesitate to contact our office.

Yours truly,

Garry Leithead
Executive Director

/bp
encl.

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SUBMISSION TO THE CLEAN AIR STRATEGY

The Alberta Forest Products Association is pleased to make this submission to the Clean Air Strategy examining air quality. The AFPA represents 70 Alberta-based companies involved in the manufacture of forest products, including lumber, panelboard, pulp and paper. Our mandate encompasses lumber grading, government affairs, safety, transportation, forestry, public affairs, environment and offshore market promotion. Our membership constitutes Alberta's fourth largest industry, employing 27,000 people and in 1990, representing $1.4 billion in annual sales.

The AFPA, which has represented Alberta forest industry companies for more than 50 years, is committed to responsible environmental controls and standards and to regeneration of our forests. We have backed up this commitment with an announcement in early November of our desire for public input into developing a Forest Care process; a self regulatory code of principles , which set our own standards, displaying responsibility in areas where we have the expertise. The direction we are taking covers many of the principles which are contained in the background documents for the Clean Air Strategy. Our new code will set industry guidelines in six areas: forest management, environmental standards, land use, public communications, employee safety and sustainable economic growth.

We want our Forest Care Code to reflect the beliefs and goals of all Albertans, as well as those who work in our sawmills, pulp and paper mills, panelboard and woodland operations. This code will act in harmony with environmental legislation in Alberta and in Canada as a whole.

The pulp and paper sector of the AFPA use large amounts of energy in the form of natural gas and electricity. The electricity used is mainly generated in coal fired generating plants but significant amounts are generated from in-House generating plants which burn biomass (hog fuel) and dissolved organic compounds from the kraft pulping process. Virtually all the steam used to manufacture this electricity is then used in process heating. The solid wood sector of the industry use some natural gas and biomass heating systems to heat kilns and buildings. The major emission issue for this sector comes from the disposal of by-products namely bark, sawdust and shavings. These by-products have traditionally been burned in teepee burners. The development of the pulp industry in Alberta has been beneficial in that residual chips previously burned are now sold to pulpmills and are now being made into pulp and paper. In addition the concerns regarding landfilling of pulp and paper mill effluent treatment sludges is requiring the industry to review the potential incineration of this material at locations where burning is not currently practiced.

The industry recognizes that emissions from incineration impact the environment and are taking steps to improve the situation. The Canadian Pulp and Paper Association have studies underway to obtain better understandings of emissions from pulpmills. The AFPA is working in conjunction with Alberta Environment, Economic Development and Trade and Forest Industry Development Division of the Alberta Forest Service to better understand and make recommendations regarding use of teepee burners.

It should be pointed out that the forest industry is not a major contributor in the categories of CO_2, SO_2, NOX. Enclosed are three graphs illustrating emissions from several identified industry sectors. They are prepared from a background document "In Support of the Issues and Options Workshop, September 6-8, 1990" J.D. Smith, Albertan Energy and H. Sandhu - Alberta Environment. As such the priority of emission standards for the forest industry should certainly be less than say the energy industry, electrical generation facilities and the oil and gas sector.

Our forest products industry has responded quickly to the environmental concerns expressed by the people of Alberta. Our pulp and paper mills are committed to some of the most stringent environmental standards in the world and have been leaders in implementing technology in order to meet this demand from Albertans.

Several larger solid wood sector companies are installing systems which either eliminate or significantly reduce air emissions from waste wood disposal burners. Smaller operators are experiencing difficulty in changing their operations due to the economics involved and consideration should be given to their location and the relatively low impact of their emissions.

CONCERNING REGULATIONS

The forest products industry produces large volumes of waste such as bark, sawdust, planer shavings, effluent treatment plant wastes and trim blocks from our solid wood, pulp and paper processing installations. While some of this refuse is incinerated to produce electricity and/or process steam, significant quantities are either burned or landfilled. In certain locations, cogeneration power projects may be economically feasible which will provide for energy efficient disposal of our by–product refuse but these situations will be relatively few. The above arrangements provide for the most effective management of energy and environment impacts. In order to minimize landfill, the burning of wastes in combustion devices is most desirable. The regulatory agencies must be sensitive to these needs and develop regulations which are cost effective and not onerous upon the operator.

We believe that environmental legislation can be strengthened by coupling it with specific standards. For example, many jurisdictions in North America publish specific standards covering emissions as part of their environmental legislation. Alberta, on the other hand, has tended not to publish legislated standards. Companies require specific information within legislation to minimize uncertainty in their environmental planning, and long–term development goals.

Our members need to plan their operations, their expansions and their environmental improvements years in advance. We need time to plan the best technology, to find the financing, to consult with the public, to gain the necessary approvals and finally to carry out the work. We need to know exactly what the standards are so we can plan effectively.

The AFPA and its members have traditionally worked closely with government in providing input towards the establishment of new regulations and standards. We believe there should be even more dialogue to ensure that regulations embody sustainable development, that is industrial growth without compromising the ability of future generations to meet their needs. In the same way, we request that the federal and Alberta governments work together in an attempt to achieve a "single-window" approach to environmental regulation so that Alberta forest companies can obtain clear, consistent interpretation of standards.

As an industry, we would like to see environmental standards developed in a defined and timely way. We support appropriate and proven technology, backed by our technical resources with access to a worldwide knowledge base.

The forest industry is different from the petroleum or petrochemical industries. We deal with a renewable resource which often can't be covered under the same regulations as a non-renewable resource. In the same way, regulations which cover a sawmill aren't necessarily appropriate for a pulp and paper operation — or for a dam or a coal-fired generating station.

We recognize that general regulations may be specific enough for some sectors of the forest industry. But other sectors may need site-specific regulations. This could be compared to a general speed limit for highways. The limit is sometimes raised for a divided, limited-access highway or lowered in areas where driving is more difficult. Similarly emission standards of those plants which are urban based may be more stringent than those that are rural based.

Just as we need a rational process for regulations we require a stringent and specific protocol outlining how regulations might be changed in the future.

The legislative process must be clear and orderly for everyone so that rational decisions are made based on credible scientific assessments of what is possible and desirable for the environment combined with economic assessments of the cost to the business and society. All of us must recognize that every project has an environmental impact, the same as every human action. It is up to the assessment process to ensure that the impact is minimal and acceptable.

As an industry, we believe that the recent draft Environmental Protection and Enhancement legislation is a positive step to update current laws and incorporate the need for public input into existing legislation. At the same time, we hope that the Alberta public and the government will understand that the forest industry exists in an increasingly-competitive world marketplace. We must continue to compete successfully despite the huge costs of meeting some of the most stringent environmental standards in the world, in addition transportation costs to international markets are significantly higher here in Alberta than in most other countries and provinces.

PUBLIC PARTICIPATION

The AFPA supports effective public participation in this whole process. We have, for example, set up a phone number where Albertans can call us collect to express their concerns. Public input is a key portion of our Forest Care Code. Public involvement has become an integral part of Forest Management Agreement planning.

We believe it's only fair that everyone should know exactly what form of public consultation will meet the requirements. Historically, companies have done what was asked of them, only to be told later that it was not enough, a no-win situation for everyone.

We are concerned, however, because some public participation has turned to grandstanding and sensationalism which is counter-productive. While formal public hearings have a strong quasi-judicial function, the AFPA believes that communication can often be enhanced in a partnership approach through roundtable or workshop sessions when developing regulations and standards. The Clean Air Strategy workshops offered a good example of effective communication by honest, sincere and concerned individuals. Environmentalists, academics and representatives from industry and government broke into smaller groups to discuss the various topics and then reported back to the group as a whole.

The forest industry is a relatively minor contributor of harmful emissions into the atmosphere. The industry recognizes that it is a contributor and is prepared to work with governments in reducing and wherever possible minimizing emissions. It is important to note that burning of wastes or buy-products must continue as a method for disposal.

In summary, we believe the following measures will improve the environment and still enable the industry to be viable:

1. Development of specific environmental standards and regulations for the forest industry in an orderly process that allows government and industry to effectively deal with environmental issues.

2. Effective public participation for input to environmental laws and regulations emphasizing a "partnership" approach.

3. Specific standards for the forest industry included within the framework of environmental legislation and, in some cases, site-specific regulations.

4. Standards and regulations for the environment based on credible scientific assessments while maintaining sustainable development.

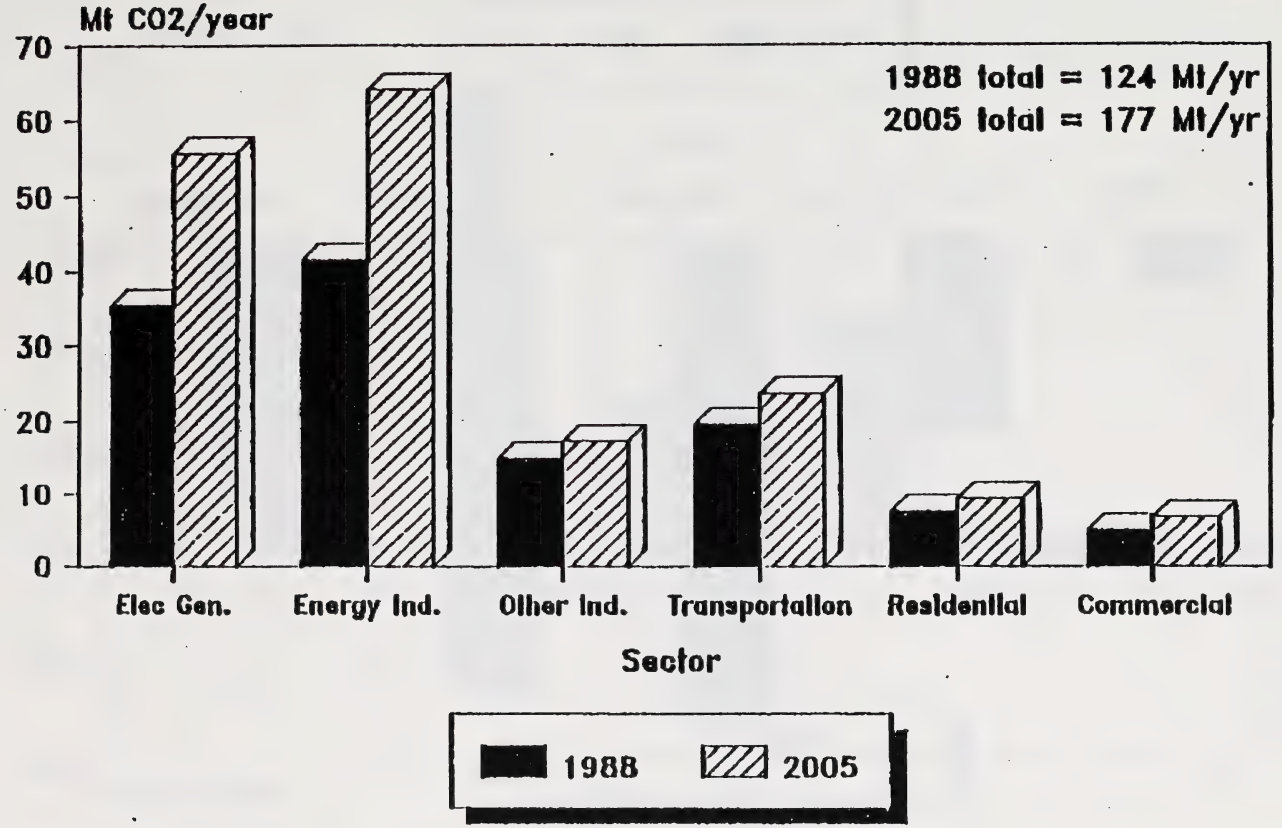
5. Establishment of a stringent and specific protocol outlining future regulation changes, including a system for ongoing communication and consultation.

6. Recognizing the competitive nature of the industry to ensure its position nationally and internationally is not eroded.

We believe that these measures will help to enhance and balance both environmental protection and industrial activity for the benefit of all Albertans.

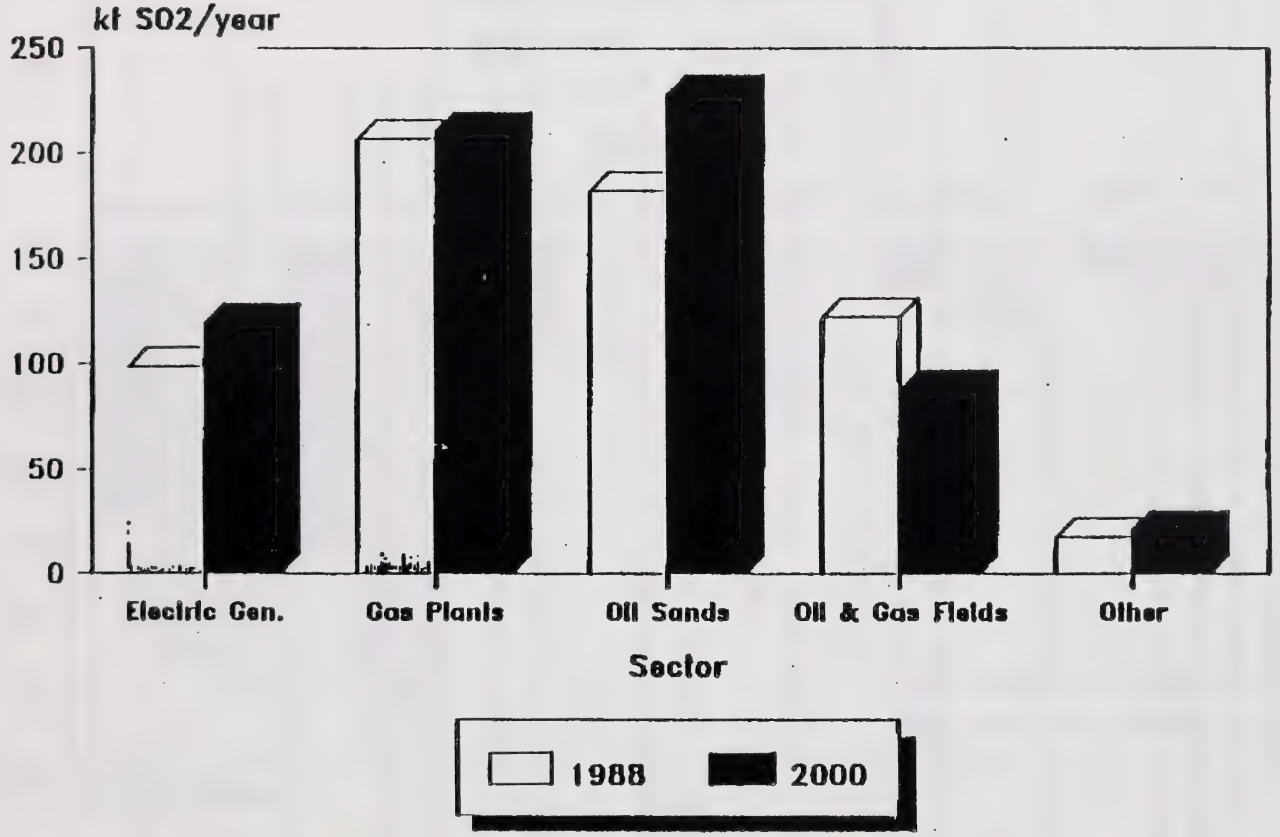
Submitted: January 15, 1991

Alberta CO2 Emissions
(In Megatonnes/year)



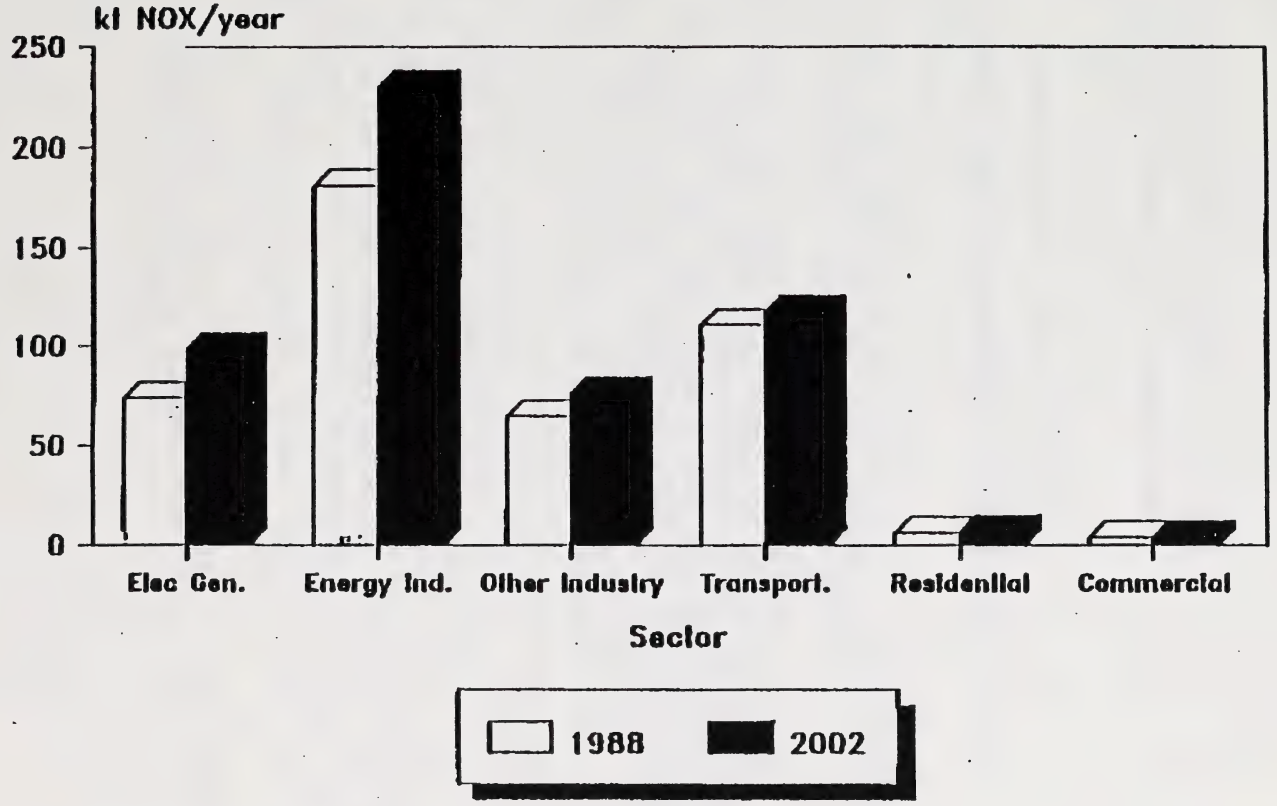
Based on ERCB 89-A Report

Alberta SO2 Emissions
(In Kilotonnes/year)



Based on data from ERCB Gas Dept.

Alberta NOX Emissions
(In Kilotonnes/year)



Based on ERCB Report 88-C

O.S. process gas and coke not included

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1991-01-10

Clean Air Strategy for Alberta
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Edmonton, AB T5K 2G6

Attention: Vern Millard, Forum Moderator

Re: Full Copy of Our Presentation at the Calgary Forum

Dear Mr Millard;

Please accept my apologies for the delay in forwarding the full copy of my presentation at the Calgary Forum (enclosed), on December 5, 1990, but I have been away for awhile.

My compliments on running a well moderated forum. I have, however, a concern that the Alberta government may only be paying lip service to an improved environment given their track record with the Old Man River dam and the latest pulp mill approval before all environmental concerns have been addressed, and also that many of these regional session hearings are postdating the submission to the CCME, and thereby the WCC in Geneva. But I suppose such is the way of our governments.

I also would like to mention, for the record, some observations on the individual brochures (blue sheets). First, on the Methane sheet, our work indicates that the global annual methane emissions for coal mining is about 58 megatonnes, not 35, which is a USDOE figure, which makes US coal mines look somewhat better, and does not sufficiently take into consideration the larger emissions from underground mines worldwide. Second, on the Greenhouse Effect sheet, the current g-h gas contributions by Environment Canada are in disagreement with the World Resources Institute, which gives: CO_2 - 49%, CH_4 - 18% (double Envir. Cda.), N_2O - 6%, Others - 13%.

I would ask that CH4 International and I be considered in further processes, and be placed on any list for notification. Thank you for your consideration.

Sincerely,

Peter J. Proudlock
President
CH4 INTERNATIONAL LTD.

enclosure

ATMOSPHERIC EMISSIONS OF FUGITIVE METHANE IN ALBERTA

A Submission to Clean Air Strategy for Alberta Forum
Calgary, Alberta, December 5, 1990

Submitted by: Peter J. Proudlock, President, CH4 International Ltd.
808 - 48 Street N.E., Calgary, Alberta, Canada T2A 4L9
Phone/Fax: 1 (403) 273-6296

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CREDENTIALS

Good evening, my name is Peter Proudlock. To state simply, my credentials in making a presentation here to the Clean Air Strategy for Alberta, are:
My company, CH4 International Ltd., works with methane gas, as an alternate fuel source from coal seams, coal mines, landfills, etc. I graduated as a geologist from the University of B.C., and my experience in the field of methane has been for over the past ten years. Some of our recent work has also included investigations into the emission of fugitive methane into the atmosphere for the Federal - Provincial Joint Task Force. Earlier this year, as Canada's invited industry representative, I attended the 40 country "International Workshop on Methane Emissions from Natural Gas Systems, Coal Mining and Waste Management Systems", sponsored by the U.S. Environmental Protection Agency and the Environment Agency of Japan, held in Washington, D.C. for the U.N.'s Intergovernmental Panel on Climate Control. Our current work continues to be involved with methane recovery and emission control.

My presentation will address atmospheric emission of methane, its affect and a some suggestions for reduction.

THE EFFECT OF METHANE ON GLOBAL WARMING

1. The Half Earth from Space

The earth, when viewed from space, has a very thin shell protecting us from solar radiation, and its affects on us; we term this fragile shell our atmosphere.

2. "Historic Increase in Atmospheric Concentration of CO_2 & CH_4"

Man's activities, over especially the last century, have dramatically altered the chemical make-up of the atmosphere. For example, we have measurements of the atmospheric concentration of carbon dioxide and methane since about 1750, and not only have the concentrations been steadily increasing, but the rate of increase is also accelerating. Methane emissions to the atmosphere are considered as part of the package of greenhouse gasses responsible for global warming.

3. "Greenhouse Gasses - Global Warming 1980's"

In 1988, the World Resource Institute estimated that 18% of the man-made contribution to the greenhouse effect comes from methane gas.

4. "Contribution to Global Warming by Major Greenhouse Gasses"

Although the contribution of carbon dioxide at 49% is greater than that of methane, the growth rate of the methane concentration, at 1% annually, is twice that of carbon dioxide.

5. "Effect Relative to CO_2 & Mean Residence Time of Major Greenhouse Gasses"

Since methane is about 60 times as damaging to the atmosphere as carbon dioxide by weight (and over 20 times by volume), and has a mean residence time of 10 years, versus 2 to 3 years for carbon dioxide, then a considerable effort should be given to reduce atmospheric emissions, and to maximize utilization.

6. "Climate Impact of Methane Emissions"

The U.S. E.P.A. in 1990 released findings that indicate that reduction of methane has a far greater affect on global warming, especially in the short term (1 year), where the impact is about 120 times that of carbon dioxide by weight (45 times by volume).

The man-made emission of fugitive methane comes from such major sources as: coal mining, the petroleum and natural gas industry, landfills, wastewater, animal wastes, land use changes and rice production. Although rice production is definitely not a consideration in Alberta, the other sources are, to varying degrees. These sources are controllable to some extent, and control would assist in the reduction of the greenhouse effect.

METHANE EMISSIONS FROM COAL MINING

7. "Coal Gas - Typical Analysis"

Almost all coal contains gas. This gas is produced as part of the coalification process; the amount of gas produced is very large. This coal gas is predominately methane (>95%).

8. "Coal Gas - Present in Coal in 2 Forms"

Most methane within coal is adsorbed, and as such the pressure within the coal is fairly low, much lower than gas in a conventional reservoir at similar depths. Only a small amount (about 5%-10%) is free gas within the porosity. This free gas is in equilibrium with the adsorbed methane, and because of the relatively low confining pressures, the methane remains adsorbed.

9. Coal Mine

Once the pressure is disturbed, as with dewatering caused by mining, the free gas is released, and desorption starts to proceed. The amount of gas that can be contained within a coal reservoir greatly exceeds that which would be contained within a conventional reservoir under similar conditions, therefore, the amount of gas released from coal can be considerable.

10. Variation in Methane Adsorption With Rank & Depth (Drawing)

The volume of gas in coal, which is emitted when mined, is dependent upon rank and depth. Since much of Alberta's coal production comes from shallow, lower rank plains coal, the emissions are not expected to be high per tonne of coal, but almost 20 million tonnes are mined annually. Presently, coal mined in the mountains (about 10 million tonnes per year), is reported to be not overly gaseous, but coal in some areas of the province is very gaseous. Besides the gas within the mined coal, any gas contained within smaller adjacent seams and any carbonaceous material disturbed by mining will be released, and this amount is often much greater than that within the recovered coal itself.

11. "Canadian Coal Mining - 1988"

Our work has indicated that Canada emits about 500 million cubic metres of methane per year from 70 million tonnes of coal mined. We have not precise figures for Alberta, but Alberta mines considerable coal (over 40% of Canadian production), and a proper testing programme to ascertain the quantity needs to be conducted. Methods exist to economically predrain gas prior to mining. Where this is possible, the gas should captured in areas and it should be utilized.

12. "World Coal Production & Methane Emissions"

Another benefit of refining the technology to recover this gas from coal mining is that this technology is required worldwide, especially in developing countries, to which we would have a valuable export of technology. Worldwide, about 4.6 billion tonnes of coal are mined; from this we estimate that 81 billion cubic metres of methane were emitted in 1988.

Although Canada's share is less than 1% of this, it is important that we are progressive and indicate to the world that we are serious about reducing emissions. The developing world, especially China for instance, relies heavily on coal for energy. China has recently stated that for at least the next 20 to 30 years they will be increasing their coal output. In that China alone accounts for 1/3 of the world's emissions from this source, and this will increase, it is imperative that the developed countries, such as Canada, develop the technology to both recover and utilize this gas, which is so damaging to the atmosphere. The Soviet Union and Poland are also large emitters, and potential technology customers.

13. Coal Mine Drainage Systems (Drawing)

The United States, which ranks second, is currently collecting a considerable amount of methane, and making money doing so. They are currently expanding their collection systems, which are mainly surface predrainage wells. Canada, also, has excellent demethanation technology, and can excel in underground systems.

14. "World & Canada 1988 Mining Methane Emissions"

Given proper technology, and the will, we estimate that 50% of emissions from coal mining can be economically recovered.

METHANE EMISSIONS FROM NATURAL GAS SYSTEMS

15. Gas Plant

Alberta has a strong natural gas industry; indeed 85% of Canada's production comes from this province. Over 100 billion cubic metres of natural gas are produced annually. The provincial average methane content is 81%, or about 85 billion cubic metres produced.

16. Flare Stack

About 2 billion cubic metres of methane, or 2%, is listed as "flared". Not all of this is actually flared, some is lost as fugitive methane. Although we have no data, we have estimated that perhaps 5%, or 100 million cubic metres is vented as fugitive methane emissions; much of this could probably be recovered.

17. Compressor Station

In areas of the world where older distribution systems are in use, there is leakage that is unaccounted, but Alberta's systems are new, and the quality of repair and maintenance is high, so this loss is minimal.

18. Gas Flaring

Most losses occur in the testing, flaring of solution gas, etc. where incomplete combustion might occur. This is certainly an area that needs evaluation.

19. Meter Station

This, however, is only the amount that is originally metered, or from wellhead to burnertip. There is no accounting for gas lost from oil production and other leaks and orphan wells that have long since been abandoned but are leaking.

20. Service Rig

Some companies are facing high costs trying to control casing gas leaks, especially in areas of the plains where rock is poorly consolidated.

21. Logging Unit

The technology of geophysical logging in Alberta is second to none in the world. We now have the capability of measuring leaks of less than one cubic metre per day. Another unaddressed area of concern is where a leak behind casing from a deeper, higher pressure reservoir has been allowing gas to flow up the wellbore, but into another higher, lower pressure zone.

22. Well Head

Given a long and large enough leak, especially if the same problem exists in a number of wells, then this zone becomes overpressured, and in poorly consolidated rocks, eventually this gas will migrate to surface and enter the atmosphere as fugitive methane. It is also a drilling hazard. The technology to measure these leaks behind casing and poor cement bonds has been developed by one Alberta firm, Roke Oil Enterprises. Probably other Alberta technologies, which are not in common usage, have equally as important implications. I have been in R&D for over a decade, and know the difficulty in introducing new quality ideas; it just is not "Canadian" to brag that "I am good", or "we have the best".

23. Drill Rig

We know these types of leaks exist; we do not know the magnitude. The implication is that the natural gas industry unwittingly emits a considerable volume of undetected fugitive methane. This area most certainly needs to be evaluated, for if there is a move to switch to natural gas, drilling and leakage will increase. Part of this increase in natural gas production will come from coalbed methane (produced from surface, as opposed to recovery from mining activities), which is already starting to be investigated in the province. Coalbed methane is becoming a significant source of natural gas in the U.S.A., where, for example, about 7000 wells will be completed this year, and where in Alabama, 15% to 20% of production is coalbed methane. We are faced with the fact that if fugitive methane leaks exceed about 1% of production, the advantage in reducing carbon dioxide and the greenhouse effect is lost; therefore, we must know how serious this problem might be, and how to reduce or eliminate it economically.

METHANE EMISSIONS FROM LANDFILLS

24. Landfill Site

The generation of methane as part of the decomposition of organic waste in landfills is well known. Up until the early 1970's, however, this gas was considered a nuisance at best and a hazard at worst.

The make-up of land fill gas is about 50% to 60% methane, the bulk of the rest being carbon dioxide. In many areas this gas is now being recovered at a profit. No such operations exist in Alberta. I do not have accurate numbers for Alberta, but considerable research has been done worldwide. For instance, a New York site of 600 hectares, 12 metres deep was shown capable of producing 1.1 billion cubic metres of 55% methane gas per year for a minimum of eight years. This research also includes upgrading and use of the gas as-is, which has the same corrosion characteristics as natural gas and with less NOx and CO emissions.

A detailed study is necessary before an estimate of the quantity of fugitive methane emissions from landfills in Alberta that can be captured. The number of sites, their sizes, composition and distance from markets needs to be addressed.

METHANE EMISSIONS FROM WASTEWATER SYSTEMS

25. Sewage Plant

Anaerobic digestion of municipal wastewater has been in use for a century. This process produces by-products such as methane, carbon dioxide and hydrogen sulphide.

26. Electric Generators

The methane gas is easily captured and used. Alberta is currently doing well in some jurisdictions in this area. For instance, the City of Calgary's Bonneybrook Plant generates about 30,000 cubic metres of methane per day from a flow of about 400 million litres of sewage.

27. Power Generation & Heating

About 80% of this is captured and utilized for heating and electricity generation for peak shaving. Base load displacement has not been economic. When I last visited the plant about a year ago, expansion of the capture and usage facilities was underway to improve on the 80%.

Detailed studies of all Alberta treatment plants should be undertaken, to ascertain if methane recovery at the smaller plants can be economic.

METHANE EMISSIONS FROM ANIMAL WASTE

28. Cattle

Anaerobic digestion of animal manures has been demonstrated to be an effective resource management tool. The system is effective in reducing pathogen and nutrient levels in the manure and in preserving the water quality in streams; methane is a major by-product of the process. On farms, capture systems do not need to be high-tech to be effective, and a medium calorific value gas is generated for use by the animal husbandry facility for heating or electrical generation.

I have no figures for Alberta, but a recent U.S.A. study indicated that about 30 billion cubic metres of biogas could be produced annually in the States. Investigations into the use of such systems under Alberta's conditions are worthwhile. As to the recovery, given Alberta's large range beef industry, perhaps 5% might be suggested.

METHANE EMISSIONS FROM LAND USE CHANGES

29. Slash Burning
30. Pulp Mill
31. Dam

In many areas of the world, large quantities of methane are emitted as a result of land use changes, such as deforestation, drainage of swamps, etc. Alberta is not likely a large contributor to this area, but certainly when large pulp mills and dams are planned, changes must take place. The magnitude of such changes and the affect these changes have on the emission of methane, as well as carbon dioxide needs to be looked at.

32. Logging
33. Smoke Blocking Sun

It may be that these effects are minimal, but we certainly lack credibility in criticizing other areas of the world, especially deforestation in developing countries, when we are doing the same thing here. We need hard numbers to back up arguments on what the differences are.

METHANE EMISSIONS FROM OTHER SOURCES

34. Calgary Skyline & Highways

Our work has identified some sources of fugitive methane emissions in Alberta, but there are certainly others, that detailed studies will reveal; automobile exhaust is one such source. In reducing fugitive methane emissions, all areas need to be investigated. If we simply concentrate on a single large source, we may miss a much larger overall abatement by harnessing a number of lesser sources.

CONCLUSION

35. "Canadian Methane Emissions & Estimated Recovery by Industry Segment"

I have discussed a number of areas of fugitive methane emissions, which are controllable to varying degrees. I am most knowledgeable of coal mining emissions, to a lesser extent in the area of conventional natural gas systems, and plead near ignorance in the other areas, but our research into methane emissions in one area has led to some knowledge of others. I have come here tonight to bring light on some areas of concern, areas needing investigation, and perhaps ideas for further research.

Work we did earlier this year has given us the following estimates of recovery by industry segment in Canada, and in some areas a guess only has been made. Because Alberta is an energy rich province, we can certainly recover 10%, and will probably be able to recover about 25% of the Canadian total.

CANADIAN METHANE EMISSIONS
& ESTIMATED RECOVERY BY INDUSTRY SEGMENT

Industry Sector	1989 Methane Emissions Millions m^3	Estimated Potential Recovery
Coal Mining	500	50% = 250
Oil & Natural Gas	2,000	10% = 200
Landfills	1,600	+/- 30% = 500
Wastewater	+/- 400	80% = 320
Animal Waste	? 1,000	? 5% = 50
Changes in Land Use & Other	?	? ?
Totals	? 5,500+	? 1,320+

36. Natural Gas Vehicle Fueling

Additionally, switching to methane from higher hydrocarbons, especially oil and coal has other advantages in reducing the greenhouse effect. For example, coal gives off about twice the amount of carbon dioxide per unit of energy recovered as does methane. This fact, that methane is such a clean fuel, gives rise to the prediction that public pressure will create a demand and a rise in price, possibly doubling, even within this decade, without any other outside influences.

I trust I have presented some new information on fugitive methane emissions from man-made sources in Alberta, indicated some sources in need of improvement and suggested areas lacking adequate informantion.

37. "CH_4 = $"

Not only is methane a clean fuel, is a valuaable resource. Hopefully, through sensible investigations and research, economic solutions to the reduction of these emissions through capture and utilization can be found.

38. Coal Mine Explosion

As in the case of the early efforts to eliminate a hazard from coal mining, it has been found that the methane itself is valuable, hopefully the same can be said of recovery from other industry segments.

39. Sulphur Pile & Stack

Another comparison might be how valuable sulphur is in Alberta, and to think that sour gas was once flared.

40. Whole Earth From Space

I implore the Government and People of Alberta to consider long and hard the consequences of not investigating and doing all we can to protect our fragile atmosphere. This is a small planet, and we all must do our share to protect it; the cost of not doing so may be beyond our means to pay. Thank you.

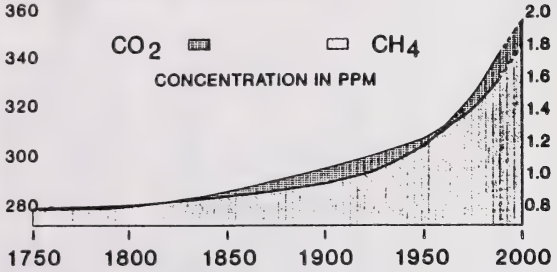
Photocopies of title slides and drawings are attached. (Note: correction to title slides reference "World Research Institute" should read "World Resources Institute".)

References and further information may be obtained by contacting:

Peter J.Proudlock, President, CH4 International Ltd.
808 - 48 Street N.E., Calgary, Alberta, Canada T2A 4L9
Telephone/Fax: 1 (403) 273-6296

②

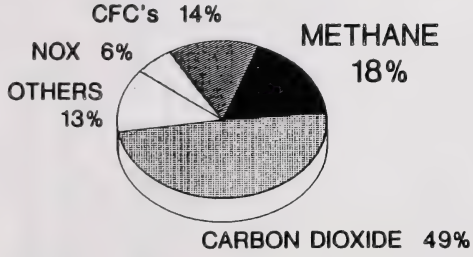
HISTORIC INCREASE IN ATMOSPHERIC CONCENTRATION OF CARBON DIOXIDE & METHANE



Source: Arking/NASA, 1990; et al CH4 INTERNATIONAL LTD.

③

GREENHOUSE GASES
GLOBAL WARMING - 1980's



Source: World Research Institute CH4 INTERNATIONAL LTD.

④

1989 CONTRIBUTION TO GLOBAL WARMING BY THE MAJOR GREENHOUSE GASES

Greenhouse Gas	Relative Effect	Annual Growth Rate
Carbon Dioxide	49%	0.5%
Methane	18%	1.0%
C.F.C.'s	14%	5.0%
Nitrous Oxides	6%	0.3%
Others	13%	1 - 5%

Source: World Research Institute, 1988 CH4 INTERNATIONAL LTD.

⑤

EFFECT RELATIVE TO CO_2 & MEAN RESIDENCE TIME OF MAJOR GREENHOUSE GASES

Greenhouse Gas	Relative Effect Per Molocule	Mean Residence Time: Years
Carbon Dioxide	1	2 - 3
Methane	20	10
Nitrous Oxides	200	150
C.F.C. - 11	13,000	70
C.F.C. - 12	20,000	110

Source: World Research Institute, 1988 CH4 INTERNATIONAL LTD.

⑥

CLIMATE IMPACT OF METHANE REDUCTIONS

Type of Impact on Global Warming	Impact Relative to CO_2 Per Kg	Per m^3
Immediate Impact over 1 year	120 times	45 times
Near-Term Cumulative over 50 years	55 times	20 times
over 100 years	35 times	15 times
Long-Term Cumulative over 500 years	~10 times	~5 times

Source: U.S. EPA Global Change Div., 1990 CH4 INTERNATIONAL LTD.

⑦

COAL GAS
TYPICAL ANALYSIS

METHANE	95 - 98%
CARBON DIOXIDE	TR - 5%
ETHANE, BUTANE, PROPANE, ETC.	1 - 8%
WATER (VAPOUR)	SATURATED

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⑧

COAL GAS
PRESENT IN COAL IN 2 FORMS

1. As FREE GAS (+/-10%):
   In Fissures and Pores in the Coal, and in Associated Rock.

2. As ADSORBED GAS (+/- 90%):
   On the Internal Surfaces of the Coal Micro-structure.

CH4 INTERNATIONAL LTD.

⑪

CANADIAN COAL MINING - 1988

	Million Tonnes	Portion
OPEN PIT MINING	66.5	95%
Bituminous 37.0		
Sub-bituminous 18.0		
Lignite 11.5		
UNDERGROUND MINING	3.5	5%
Bituminous 3.5		
TOTAL	70.0	100%

Source: Coal Association of Canada CH4 INTERNATIONAL LTD.

(12)

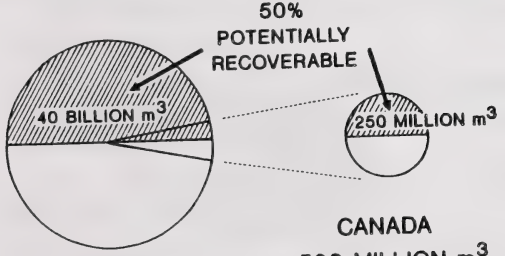
WORLD COAL PRODUCTION & CH_4 EMISSIONS

COUNTRY	MEGATONNES COAL U/G	SURF.	TTL.	CH4 EMISSIONS MILLION m^3	%
CHINA	890	37	927	26,811	33.0
U.S.S.R.	430	330	760	13,890	17.1
UNITED STATES	330	490	820	11,370	14.0
POLAND	193	73	266	6,009	7.4
SOUTH AFRICA	111	62	173	3,516	4.3
INDIA	85	100	185	2,850	3.5
WEST GERMANY	79	109	188	2,697	3.3
UNITED KINGDOM	86	16	102	2,628	3.2
AUSTRALIA	47	143	190	1,839	2.2
NORTH KOREA	38	60	98	1,320	1.6
CZECHOSLOVAKIA	26	100	126	1,080	1.3
EAST GERMANY	0	303	303	909	1.1
SOUTH KOREA	22	0	22	660	0.8
FRANCE	11	59	70	507	0.6
CANADA *	4	66	70	500	0.6
SPAIN	11	55	66	495	0.6
JAPAN	10	0	10	330	0.4
OTHERS	119	100	219	3,870	4.8
TOTALS	2492	2103	4595	81,281	100.0

Sources: World Bank, 1987; * Maszi & Proudlock, 1989 CH4 INTERNATIONAL LTD.

(14)

WORLD & CANADA - 1988 MINING METHANE EMISSIONS



Sources: W.R.I; Maszi & Proudlock, 1989 CH4 INTERNATIONAL LTD.

(35)

CANADIAN METHANE EMISSIONS & ESTIMATED RECOVERY BY INDUSTRY SEGMENT

Industry Sector	1989 CH_4 Emissions Million m^3	Estimated Potential Recovery
Coal Mining	500	50% = 250
Oil & Natural Gas	*2,000	10% = 200
Landfills	1,600	+/- 30% = 500
Wastewater	+/- 400	80% = 320
Animal Manure	? 1,000	? 5% = ? 50

* Mostly flared

Source: Maszi & Proudlock, 1989; et al CH4 INTERNATIONAL LTD.

(37)

METHANE DRAINAGE FROM COAL MINES

$CH_4 = \$$

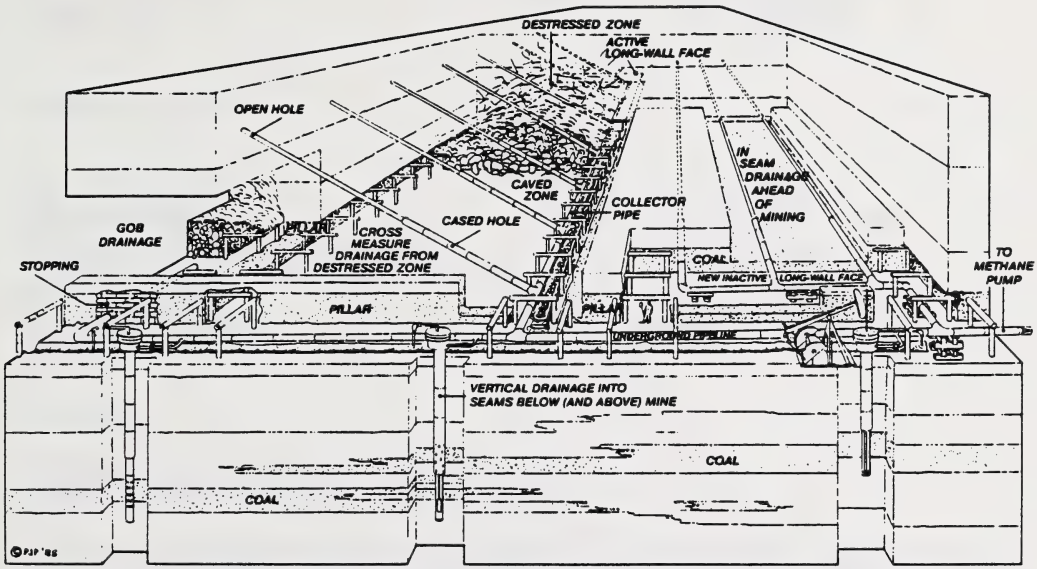
CH4 INTERNATIONAL LTD.

(13)

CH4 International Ltd.

808 - 48 Street, N.E.
Calgary, Alberta, CANADA
T2A 4L9
Telephone 1 (403) 273-6296

COAL MINE DRAINAGE SYSTEMS



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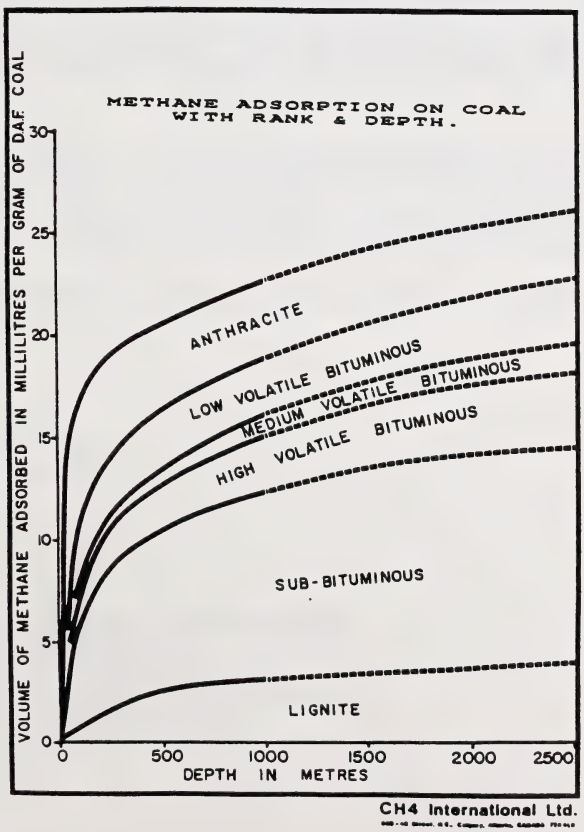


Esso Resources Canada Limited

Esso Plaza
237 Fourth Avenue Southwest
Calgary, Alberta
Canada T2P 0H6

J. W. Pollock
General Manager

Environment and
Communications Division
Tel. 403 237 4039
Fax. 403 237 3611

January 11, 1991

Mr. N.E. MacMurchy
Alberta Energy
Sustainable Energy Development
10th Floor North Tower Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Mr. K.R. Smith
Alberta Environment
Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Dear Sirs,

IMPERIAL OIL LIMITED'S SUBMISSION TO THE CLEAN AIR STRATEGY FOR ALBERTA (CASA)

The attached submission has been prepared as Imperial Oil's contribution to the CASA initiative. We view CASA as an important starting point for improving our collective ability to manage air quality in Alberta. The submission emphasizes the importance of the supporting processes and framework applied to management of air quality that will enable Alberta to effectively respond to current and future air quality challenges over the long term.

Recommendations outlined in the submission are intended to provide a basis for dialogue and discussion. In this regard, we would appreciate the opportunity to discuss the submission directly with you at your convenience. I will be contacting you in the near future to make appropriate arrangements.

If you have any comments or questions, please contact me at 237-4039 or Gord Lambert at 237-3872.

Sincerely,

J.W. Pollock

GRL/mjes/Attachment

Copy: Mr. R.H. Michell, Alberta Energy, Edmonton (10 copies)
Mr. I. Burn, Alberta Energy, Edmonton
Mr. R.J. Hicks, Alberta Environment, Edmonton
Mr. H.S. Sandhu, Alberta Environment, Edmonton
Mr. R.J. Ottenbreit, Esso Resources, Calgary
Mr. G.R. Lambert, Esso Resources, Calgary

Imperial Oil Limited
Submission to the

Clean Air Strategy for Alberta

Imperial Oil

JANUARY 1991

Foreword

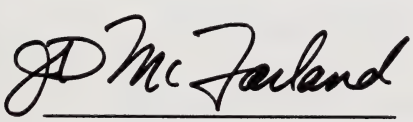
Imperial Oil Limited ("Imperial") is pleased to offer the following response to the provincial government's Clean Air Strategy for Alberta (CASA) initiative.

As a major producer of hydrocarbons, refined petroleum products and petrochemicals, Imperial has a significant operating presence in Alberta and Canada. Thus, we have an important stake in the development of public policies that address air quality issues.

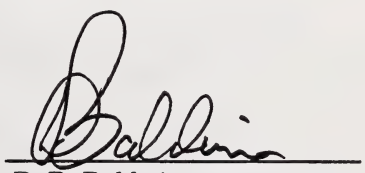
In addition, Imperial is committed to helping meet the environmental challenges facing Albertans and Canadians. We have work under way to contribute to the further development of Canada's Green Plan, including a seven-point work program relating to potential global warming and discussion papers on air quality and economic instruments to achieve environmental objectives. Much of this work will have relevance for the Clean Air Strategy for Alberta (CASA).

A key theme that continues to permeate our thinking is the need to strike a balance between environmental concerns and economic priorities. We firmly believe that a strong economy provides the means of achieving improvements in environmental quality.

We welcome the opportunity to contribute to this commendable initiative and look forward to participating in the public debate that will lead us to a successful clean air strategy for Alberta.



J. D. McFarland
Vice-President
Environment
Imperial Oil Limited



D. D. Baldwin
President and
Chief Executive Officer
Esso Resources Canada Limited

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1. Introduction

Imperial Oil Limited is pleased to participate in the development of the Clean Air Strategy for Alberta (CASA). We are committed to helping find effective solutions to Canada's environmental challenges. And we believe that through papers such as our current CASA submission, our *Discussion Paper on Potential Global Warming* and our *Response to The Green Plan: A National Challenge* we are making a valuable contribution to this end.

Each of our contributions, although responding to a separate challenge, is based on guiding principles, which reflect lessons learned from the past and provide a framework for the future. Our guiding principles recognize that we, as a society, must:

- strike the balance between environmental and economic priorities
- search out the best thinking of all stakeholders
- enroll those closest to the problem to help find solutions
- apply sound science to define problems and guide solutions
- utilize market forces to evoke the creative talents of the private sector
- harmonize environmental legislation across the country to foster efficient and effective action
- seek global solutions to global problems, regional solutions to regional problems and local solutions to local problems

The comments and recommendations contained in this submission reflect our guiding principles. They also reflect our belief that by enhancing the quality and application of planning, decision-making and regulatory processes, we will be in a strong position to effectively manage air quality in Alberta *and* Canada.

2. Air Quality Management Priorities and Objectives

2.1 Defining Problems

Stakeholder consultation is essential to effective problem definition. Therefore, a key objective of the problem-definition process is to engage stakeholders in constructive dialogue that identifies and defines significant issues, concerns and problems.

Constructive dialogue, however, requires that stakeholders receive complete, accurate and relevant information that is presented in a meaningful way.

For example, to participate in a constructive dialogue about current and future emissions and their associated environmental implications, stakeholders require emissions inventory data showing total emissions of a particular pollutant (e.g., SO_2) assessed against levels associated with known or anticipated environmental impacts.

Imperial's experience with the OSLO project, where project activities and associated cause-and-effect relationships are presented schematically for stakeholder review and comment, demonstrates that constructive dialogue and successful problem definition are possible.

Recommendations

- *Ensure stakeholders receive complete, accurate and relevant information that is presented in a meaningful way. Ensure cause-and-effect relationships are identified.*
- *Where cause-and-effect relationships are not known, focus research efforts on addressing key areas of uncertainty.*

- *Ensure problem definition describes the dynamic elements contributing to current or future problems. For example:*

    - *population trends*
    - *ambient air quality*
    - *climatology*
    - *energy production and use patterns*
    - *economic development activity*

- *Include risk assessment as an integral element of problem definition.*

2.2 Setting Priorities

It is critical that we act cooperatively to make the most effective use of limited financial, human and institutional resources. As a society we recognize the need to improve environmental quality; thus, we cannot afford to take an unfocused approach that diverts our attention from the most significant environmental problems to those that are currently less important. This requires that we assign clear priorities to air quality problems and possible actions, and regularly test these against other environmental priorities.

However, the fact that resources are limited is often not explicitly recognized in the stakeholder consultation process. And it can be predicted that the number of environmental problems and possible solutions that will arise in any consultation process will likely require resources that exceed the level of resources available. In other words, before the consultation process even begins, we know that we will have to decide on the relative priority of problems to be addressed and actions to be taken to address them.

Therefore, the consultation process should initially focus on developing a clearly defined decision-making process that outlines specific decision criteria and their application for determining relative priorities. Ideally, those criteria would be established in consultation with stakeholders before debating issues and opportunities. That consultation would give stakeholders an understanding of how decisions are to be made, ultimately increasing their commitment to the final results.

Stakeholders must also understand that priorities are relative — not absolute. The process for establishing relative priorities must be dynamic, to respond to changing factors such as scientific knowledge, national and international initiatives, economic conditions, industrial development activity and international competitiveness considerations.

As factors change, priorities are revisited. Thus, items that are not a high priority today might be a high priority two years from now. And as higher priority items are addressed, efforts can be redirected to address lower priority items.

Recommendations

- *Emphasize that priority setting is a dynamic process that responds to the changing nature of factors influencing air quality management.*
- *As a prerequisite to debating issues and opportunities and in consultation with stakeholders, establish and rigorously apply a clearly defined decision-making process that identifies specific criteria and their application for determining relative priorities.*
- *Ensure priorities are clearly established at all times so that limited resources are directed to the highest priority problems.*
- *Revisit priorities periodically, in response to new knowledge, or as progress is made in addressing previously established high-priority problems.*

2.3 Setting Targeted Objectives

Many of the relatively low-cost, high-benefit opportunities for improving air quality have already been captured. For example, over the past 20 years in Canada, ambient concentrations of sulphur dioxide and carbon monoxide have decreased over 60 percent, suspended particulates are down over 40 percent and nitrogen dioxide is down almost 30 percent. We're making progress as measured by the National Air Pollution Surveillance Network.

However, future improvements will tend to have relatively higher cost for relatively smaller incremental benefits. Therefore, when establishing

objectives, it is becoming increasingly important to consider economic implications in addition to environmental protection requirements. In other words, we must integrate environmental and economic considerations in air quality management.

Establishing pollutant- and problem-specific (i.e., targeted) objectives is necessary to facilitate air quality management in Alberta. Currently, however, our approach is to either set province-wide objectives and standards for ambient air quality or to set point-source emissions limits (generally based on emission rates). Neither mechanism directly acts to control total emissions loadings, which is key to minimizing adverse environmental effects.

An alternative approach is to assign pollutant-specific, total-loading objectives (often referred to as "caps") to address specific air quality concerns. Those could be targeted on a global, regional or local basis depending on the nature of the particular problem. This way of defining objectives focuses regulatory objectives on real current or future problems in the area they exist, which in turn leads to improved economic efficiency in addressing air quality problems.

Recommendation

- *Develop a formal process, supported by stakeholders, to select economically viable and environmentally substantiated and targeted objectives (e.g., pollutant specific, total loadings) in an optimum time frame and on an appropriate geographic basis to address specific problems. This process must include:*

    - *developing scenarios involving considerations such as:*

        - *alternative total loading targets*
        - *alternative time frames to achieve identified targets*

    - *assessing relative environmental benefits and risks*

    - *comparing and assessing economic implications (e.g., marginal costs associated with incremental benefits)*

    - *determining the technical feasibility of possible objectives*

3. Regulatory and Administrative Processes

3.1 Regulatory Framework

The use of air quality management zones provides a basis for spatially defining pollutant-specific air quality problems in relation to current or potential risk of environmental damage.

In the United States' new Clean Air Act, the air quality management zone concept is used to establish a cap on acid forming emissions. The cap focuses on the Ohio Valley and Northeastern United States because point sources are largely concentrated in those regions, and SO_2 and NOx total loadings from this collection of point sources are the critical factors in minimizing adverse environmental effects. It should be noted that the zone targeting approach does not arbitrarily recognize political (provincial, state or national) jurisdictional boundaries; rather, it recognizes specific problem areas.

Environment Canada, too, used this concept for the recent NOx and VOC Management Plan. In the Plan, the Quebec City-Windsor corridor is focused on as a "region" of concern within which specific zones will be targeted for specific actions.

This type of framework provides a focused basis for addressing air quality problems. In addition, the framework provides flexibility for responding to changing air quality concerns and is compatible with the concept of applying the most effective regulatory instrument(s) to a specific problem.

Recommendation

- *Adopt the use of air quality management zones that:*
  - *spatially define pollutant-specific air quality problems, based on the best available knowledge of:*
    - *sources, loadings*
    - *dispersion characteristics (spatial and temporal)*
    - *cause-and-effect relationships (ecological impacts)*
    - *risk and long-term trend assessments*
  - *are established, amended or deleted in response to new information or changing priorities*
  - *allow targeted objectives to be established on a zone-specific basis*

3.2 Regulatory Instruments

Air quality issues and associated command and control regulations to address those issues are increasingly complex, costly and interdependent. Thus, there is a need for government and industry to pursue additional flexibility and innovation in applying regulatory instruments to mitigate or eliminate air quality problems.

Alternative approaches to command and control mechanisms, such as tradeable emission rights, appear promising for achieving some desired environmental objectives in a more cost-effective way. Other economic instruments – including various incentives – have not yet been fully explored but may emerge as useful regulatory instruments. Instruments that act to channel market forces can be a powerful means of tapping the creativity of the private sector to achieve environmental objectives in the most cost effective way.

Recommendations

- *Develop flexibility in the types of regulatory instruments available so that the most effective instrument can be applied to achieve a specific objective.*

- *Incorporate a provision that explicitly acknowledges the existence of alternative approaches to command and control mechanisms including market-based approaches (e.g., tradeable emission rights) into The Alberta Environmental Protection and Enhancement Act. The provision should provide the Minister with the authority to adopt alternative instruments where appropriate.*

- *Structure regulations related to regulatory instruments so that environmental effectiveness is ensured in the most cost effective way (i.e., minimize regulatory complexity).*

3.3 Monitoring and Reporting

The full benefit of air quality data currently being collected is not being realized. The primary use of data submitted currently is to determine compliance. While this is an important objective of air quality monitoring and reporting, it should not be the sole objective. Instead, we should focus on using air quality data more effectively to support air quality management.

Currently, stakeholders receive inadequate feedback about air quality trends that, if available, could be used to encourage positive behaviour and support decision making at all levels. In addition, increased effort must be placed on scientific analysis and assessment not only related to the nature of emissions but also to causes and effects.

Recommendations

- *Use air quality monitoring to:*

  - *contribute to a better-informed public*

  - *test for compliance with appropriate regulations and standards*

  - *collect, compile and report data that supports air quality management (e.g., updated emissions inventories, trends)*

  - *support scientific research on key air quality issues*

  - *provide timely feedback to the public and industry on current status of air quality and progress in meeting targets and objectives*

- *Develop a partnership among industry, government and the public to support air quality monitoring.*

- *Ensure cost effective use of resources among all stakeholders in efforts related to monitoring and reporting.*

- *Develop and apply improved management and assessment tools (e.g., dispersion and airshed models).*

- *Consolidate organizational responsibilities for managing air quality information, including researching, monitoring, reporting and analyzing.*

3.4 Consultative Decision Making

Affected stakeholders must be consulted throughout the decision-making process to ensure economic and environmental implications are fully understood and assessed.

A consultative decision-making process not only ensures better quality decisions, it increases stakeholders' commitment in the ultimate decision and its implementation.

Recommendations

- *Make decisions using processes and criteria established in consultation with the broad-based public.*

- *Ensure decision-making processes recognize both economic and environmental implications.*

- *Use a consultative decision-making process to develop and maintain an air quality management framework that would:*

    - *define priorities*

    - *define air quality management zones where appropriate*

    - *establish targeted objectives within those zones*

    - *specify the most appropriate regulatory mechanisms to meet specific objectives*

- *Provide Alberta Environment with the responsibility for developing and maintaining the framework using a consultative approach to problem definition and decision making.*

- *Ensure the consultation process includes Alberta Energy, Energy Resources Conservation Board, Alberta Health, industry, the scientific community and directly affected members of the public.*

- *Communicate decision-making reasoning to stakeholders.*

4. Summary

The Clean Air Strategy provides an opportunity to consider how Albertans can most effectively manage air quality over the long term. The recommendations outlined in our submission represent Imperial's view of how this might be achieved.

The anticipated benefits of these recommendations are that Alberta would:

- integrate economic and environmental considerations
- be responsive to change
- effectively allocate limited resources

Together, these benefits translate into an overall improvement in our ability to maintain and, where necessary, enhance air quality for all Albertans. They also enable the province to fulfill its commitment to address the broad spectrum of air quality issues inside and outside its boundaries.

Our Commitment

Imperial is committed to working with stakeholders to explore and develop the recommendations outlined above. We will continue to provide the company's unique perspective, together with information and analysis from our operations and activities, to support provincial initiatives.

In addition, Imperial is committed to providing sound information through monitoring and reporting of air emissions associated with our operations and to assist in developing an improved understanding of their environmental impacts.

Electric Utility Planning Council

Management Committee
Alberta Power Limited
Edmonton Power
The City of Calgary
TransAlta Utilities Corporation

February 1, 1991

Mr. Bob Mitchell,
Clean Air Strategy for Alberta,
Bag 1, Mail Room,
Main Floor, North Petroleum Plaza,
9945 - 108 Street,
Edmonton, Alberta.
T5K 2G6

Dear Mr. Mitchell:

Attached please find a copy of the Electric Utility Planning Council's submission to the Clean Air Strategy for Alberta. The Electric Utility Planning Council views the Clean Air Strategy for Alberta as an important initiative and looks forward to continued participation in the spring workshop and subsequent public discussions.

Our submission briefly describes the contribution already made by the electric utilities to air quality management in Alberta; identifies consumer and utility opportunities to manage air emissions; and proposes steps we can take together to move the Clean Air Strategy forward. An agenda for the future is proposed to overcome, in particular, the regulatory issues affecting environmental management.

The Electric Utility Planning Council's submission is made with the expectation that it will contribute positively to management of air quality issues in Alberta. We welcome any inquiries you may have concerning our submission and look forward to working with you to move the Clean Air Strategy forward.

Yours truly,

G.M.Steeves,
Chairman,
Management Committee.

PDL/kh
Attachment
c.c. Mr. Norm MacMurchy
Mr. Ken Smith

Clean Air and Alberta's Electric Utilities

a submission to the

Clean Air Strategy for Alberta

January 1991

Electric Utility Planning Council

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Electric Utility Planning Council

Alberta Power Limited
Edmonton Power
TransAlta Utilities Corporation
City of Calgary Electric System
City of Lethbridge
City of Medicine Hat
City of Red Deer

Introduction

The Clean Air Strategy for Alberta (CASA) process is one important element of a continuing effort to address clean air-related issues in the province. Coming to grips with environmental challenges is a multi-stage process including:

- The precise identification of a current or prospective problem;
- The delineation of contributing factors;
- The identification of barriers that affect the ability to address an issue;
- The assessment of available approaches to deal with particular issues including a consideration of relevant social and economic impacts of alternative strategies;
- The establishment of achievable objectives within a realistic time frame;
- The development of a suitable framework that will allow and encourage all parties to assume their respective responsibilities;
- The establishment of reliable means to measure progress in meeting an identified objective.

The efforts identified above require thoughtful consideration and an appropriate sharing of responsibilities. Regulators, in consultation with electric utilities and stakeholders must establish appropriate environmental objectives. Industry and electric utilities, in particular, must be given the flexibility to devise appropriate technical and other approaches to meet an identified objective.

At all stages of the environmental decision-making process, electric utilities and stakeholders must be involved. Dealing with environmental challenges is an integral part of the electric utility business. As such, utilities have a keen understanding of many of the practical considerations involved in pursuing responsible environmental policy and management.

The main purpose of this submission is to identify a number of specific issues and some proposed approaches that will ensure the regulatory system provides needed flexibility to meet environmental challenges in a focused and responsible fashion.

This brief provides some background information about the electric utility industry in Alberta, the air-related impacts of electrical generation, some efforts that have been undertaken to reduce emissions and current options under consideration to minimize future impacts. An outline of principles to guide regulatory initiatives is offered, as is an agenda for future action.

I. Industry Background

Electricity in Alberta is generated and distributed by two investor-owned companies, TransAlta Utilities Corporation and Alberta Power Limited, as well as two municipally owned utilities, Edmonton Power and the City of Medicine Hat. The cities of Calgary, Red Deer and Lethbridge distribute electricity within their municipalities. In addition, there is some limited non-utility generation in the province.

Because planning a major electric generation project and bringing it on stream requires a long lead time, it is important to predict future energy demand as accurately as possible.

In 1972, utilities in Alberta established the Electric Utility Planning Council (EUPC) to coordinate planning for future electrical needs. Every year, the EUPC produces a range of electric energy and demand forecasts reflecting various possibilities for economic growth in Alberta.

II. Air emissions by electric utilities

As a result of an available abundance of fossil fuels, about 85 to 90 per cent of all electricity in Alberta is produced by seven coal-fired generating stations. The remainder of the province's electrical needs are met by natural gas, hydro and diesel-driven technologies.

In the process of generating electricity from coal-fired facilities, flyash, sulphur dioxide (SO_2), oxides of nitrogen (NOx), carbon dioxide (CO_2) and water vapor are produced.

Over the past two decades, electric utilities have made major strides in reducing emissions from coal- and gas-fired power plants to meet provincial and federal standards. To date, standards for CO_2 have not been established. The issue of climate change and CO_2 will be discussed in subsequent sections of this submission.

A number of natural advantages and technological advances have enabled Alberta's utilities to responsibly manage air emissions:

Abundant, available low-sulphur coal

Alberta has an abundance of accessible, low-cost, low-sulphur coal that ensures sulphur emissions from coal-burning generating units are low.

Improvements in boiler design

Improvements in both coal and natural gas-fired boiler design have resulted in significantly reduced emissions of oxides of nitrogen and have enabled utilities to extract more kilowatt-hours of electricity from a unit of fuel.

High efficiency dust removal systems

Over the last 20 years, the efficiency of removing flyash from stack gases has increased from less than 85% to 99.5%.

III. Future options

The challenge facing the electric utility industry is to satisfy the needs of customers while ensuring that environmental impacts are minimized.

Among the options to reduce air-related impacts are:

- Making more use of energy efficiency and conservation measures by utilities and customers;
- Participating in the development of new pollution abatement and electric generation technologies;
- Using alternative energy sources and technological options.

Potential energy efficiency measures

Conservation

Government and industry studies indicate that residential, commercial and industrial efforts can play an important role in reducing consumption of energy. These demand-side management measures do not, however, have the same potential for the electric industry as in other provinces due to the use of natural gas for most of Alberta's heating requirements. Further improvements in the efficiency of electricity generation, transmission and distribution can also result in reduced emissions.

Electrotechnologies

Variable Speed Drive motors installed on industrial equipment allow oilfield operations, for example, to meet variable power needs and reduce electricity consumption. Other examples of electrotechnologies with potential to increase energy efficiency include the use of electric furnaces in steel making and high efficiency electric drives.

Cogeneration

Heat is produced as a by-product when electricity is generated or as a result of other industrial proceses. Waste heat produced by utilities can be captured to provide useable energy. As well, heat produced as a result of manufacturing, processing and other industrial activities can be used to generate electricity. Both processes are known as cogeneration. One example under consideration is district energy.

In Alberta, there is considerable potential to use cogeneration technologies as a means of increasing energy efficiency and reducing emissions.

Potential technologies to reduce air emissions

Alberta utilities are involved in a variety of initiatives in the province and through the Canadian Electrical Association to test new emission prevention and abatement measures. The efforts include:

- *Testing of coal burning technology that significantly reduces sulphur dioxide and oxides of nitrogen*

  Alberta utilities are taking a lead role in the testing of a low NOx - SOx burner in Cold Lake.

- *Assessing various processes to reduce sulphur emissions*

  Alberta utilities are monitoring flue gas desulphurization technology such as fluidized bed combustion and sorbent injection.

- *Assessing the use of coal gasification to reduce emissions*

  Alberta utilities, through the Coal Association of Canada, are currently examining the feasibility of testing an Integrated Coal Gasification Combined Cycle (IGCC) unit that may reduce emissions.

- *Assessing other processes to further reduce emissions*

  The use of gas turbines with steam injection is being evaluated to control NOx emissions. As well, utilities are supporting efforts to improve energy efficiency with emerging technologies such as fuel cells.

- *Research into CO_2 extraction and disposal technologies*

  Alberta utilities are participating in research and technology development for CO_2 extraction and disposal through such efforts as enhanced oil recovery schemes.

Potential energy sources

Wind, hydro, solar power, biomass, energy recovery, landfill gas utilization, nuclear and power purchases from utilities outside Alberta and independent producers may well come to play a more important role in meeting electric power needs in the future.

IV. Principles to guide regulatory initiatives

The regulatory system plays a crucial role in determining how environmental challenges are to be tackled. Governments and regulatory bodies should work with industry and concerned stakeholders in a coordinated and cooperative fashion. In this way, a realistic environmental agenda will emerge. Such an agenda should incorporate a suitable division of tasks and responsibilities to meet mutually acceptable and achievable environmental targets.

As noted earlier, the most effective way to ensure environmental challenges are addressed effectively, is for government, regulatory bodies, industry and concerned stakeholders to agree upon suitable environmental objectives concerning identified environmental problems. Such an approach should not see government or regulatory authorities impose specific solutions on industry or consumers. In order to ensure that the most appropriate solution is adopted in a cost-effective manner to meet a particular environmental challenge, it is crucial that the regulatory framework allows for flexibility of response.

The EUPC suggest the following principles should be considered in regulatory relationships with respect to environmental matters:

1) Consultation with concerned parties

As part of developing legislative or regulatory standards, there should be adequate and open consultation with scientific, industrial, consumer and community interests. The EUPC supports the approach used in developing the NOx/VOC management plan and the consultative processes that led to the development of the Canadian Electrical Association - Environment Canada Code of Practice for steam electric generating stations.

2) A need for realistic targets

Environmental objectives including emission targets must take into account what is in fact achievable within a given time frame in light of available technology, the social and economic costs of meeting particular standards and the environmental impact of available alternatives. The environmental agenda should focus on bona fide concerns such as activities that harm human health or jeopardize the ability of the ecosystem to absorb environmental impacts.

In Alberta, environmental problems vary regionally. Some areas of Alberta, for example, are more susceptible to acid deposition than others. As such, it is appropriate to establish regional targets that reflect local conditions. Broad-brush targets that do not, in effect, relate to an identifiable problem in a particular region result in wasted efforts that are costly to consumers.

3) A comprehensive approach to regulation

Environmental initiatives cannot be taken in a piecemeal fashion. Regulatory measures that result in the reduction of emissions of one substance must avoid causing an increase in the emission of another, more detrimental pollutant. It would be undesirable to devise a solution to an air quality concern only to cause a difficulty with solid waste management. For example, sludge created as a result of flue gas desulphurization should not result in undesired land-related impacts or increases of other air emissions.

4) Consistency and coordination

Environmental standards, enforcement and reporting requirements should be coordinated between federal and provincial jurisdictions. Competing or inconsistent regulatory regimes result in planning uncertainty. Duplication of environmental reporting requirements imposes an unnecessary administrative burden on industry and increases costs to consumers. A one-window approach to environmental monitoring and reporting is the most effective approach.

5) Flexibility, practicality and innovation

The regulatory climate has a direct bearing on the degree of flexibility available to industry and consumers to meet environmental objectives. Efforts to foster flexibility of response include:

- Encouraging the use of market forces where appropriate to foster environmental innovation and entrepreneurship;

- Encouraging approaches that make economic sense in their own right (such as some consumer conservation efforts) while priorizing other approaches on the basis of their environmental effectiveness per dollar of value;

- Encouraging a staged approach to dealing with major environmental measures.

6) Prevention of future problems

Over the years, Alberta utilities have invested substantially in pollution abatement technology to meet and surpass federal and provincial air emission standards. At present, the province's air quality is generally considered to be good. Prevention of future problems should be achieved by allowing utilities the flexibility to meet air quality goals in the most cost-effective manner. In the absence of scientific evidence that supports the existence of regional air quality problems, new source performance standards should be confined to future plant approvals.

V. An Agenda for the Future

Efforts to protect air quality in Alberta will be enhanced if additional attention is devoted to four subject areas:

1) Regulatory and policy barriers

2) Climate change and acid rain

3) Research and development initiatives

4) Information and educational efforts

1) Regulatory and policy barriers

In some instances, policy and regulatory uncertainty impede efforts to pursue certain emission reduction alternatives. The following list (not in any particular prioirity) includes barriers created by the Alberta system and possible measures to mitigate them. This brief does not present detailed solutions. Rather, the EUPC hopes that in due course, regulatory authorities will devise more detailed policy in concert with utilities and stakeholders. The long-term intent is to ensure the regulatory environment is sufficiently flexible to encourage a range of alternative responses to environmental challenges.

A) Issue requiring attention: **Uncertainty concerning environmental regulation**

There is a lack of clear rules regarding the environmental regulatory approval process, especially with regard to environmental impact assessments.

Desired outcome

- Federal and provincial roles in the environmental regulatory

process should follow a one-window approach in order to avoid duplication.

- Regulations concerning the Alberta Environmental Protection and Enhancement Act governing environmental impact assessments should provide a reasonable level of certainty with regard to timing and closure. EIA requirements should be comprehensive and include appropriate timelines for completion, and regulatory decisions should be definitive.

B) Issue requiring attention: **Uncertainty following environmental approvals**

In the Alberta Environmental Protection and Enhancement Act, there is a proposed provision that conditions in an environmental approval to construct can be altered at any time. This creates uncertainty and lowers the value of an approval in the eyes of potential investors.

Desired outcome

Consideration should be given to addressing this concern before the legislation is finalized.

C) Issue requiring attention: **Clarification of regulatory roles**

In some instances, it is uncertain whether a regulatory approval by one regulatory body will be upheld or altered by another.

Desired outcome

Efforts should be undertaken to clarify and streamline the roles of Alberta Environment, the Alberta Energy Resources Conservation Board, the Alberta Public Utilities Board and the Natural Resources Conservation Board as they concern environmental approvals.

D) Issue requiring attention: **Clarification of air emission objectives**

There is a need to delineate specific clean-air objectives for the province as a whole and on a regional basis. The clarification of such objectives would focus attention on appropriate action.

Desired outcome

Efforts which would be consistent with establishing air quality objectives include:

- The development of an air quality index for the province;
- The finalization of regional acid deposition targets;
- The development of appropriate targets for CO_2 emissions in consultation with industry and stakeholder groups.

E) Issue requiring attention: **Incentives to encourage environmental initiatives**

In order to encourage environmental initiative, appropriate incentives should be examined by regulatory authorities and concerned stakeholders. Suitable incentives will stimulate innovation and ensure environmental costs are integrated into decision-making.

Desired outcome

Among some possible incentives worthy of further examination are:

- Measures that ensure equitable Alberta Public Utilities Board treatment of environmental initiatives which encourage utilities to surpass standards;

- The use of tradeable emission permits;

- Provision for the immediate banking of credits for emission reductions below current standards against future emission requirements;

- Basing new source emission standards on the amount of useful energy produced rather than the amount of a resource consumed in the production of electricity. This will encourage further energy conversion efficiency.

F) Issue requiring attention: **Establishing conservation and energy efficiency programs**

Clear conservation targets and timelines should be delineated for the province in consultation with concerned parties. Such an effort would complement a clean air strategy.

Desired outcome

Among measures that would complement conservation and energy efficiency programs are:

- Favourable treatment by the Alberta Public Utilities Board of investment in conservation and energy efficiency measures;

- The support of Canadian standards for energy efficiency in buildings, motors and lighting.

G) Issue requiring attention: **Clear rules for DSM investment**

There is a lack of clear direction concerning the treatment of electric utility costs for investment in Demand-Side Management (DSM) measures which conserve energy. The rules regarding the treatment of DSM measures are emerging on a piecemeal basis.

Desired outcome

It is recommended that government departments and the Alberta Public Utilities Board move quickly to address this issue in consultation with the electric utilities and other key stakeholders.

H) Issue requiring attention: **Guidelines for cogeneration**

Recognizing the potential for environmental benefits associated with cogeneration, there is a need to establish guidelines for industry and electric utility cogeneration projects.

Desired outcome

Stakeholders and concerned parties should develop appropriate guidelines to foster the development of cogeneration projects.

I) Issue requiring attention: **Reconsideration of provincial fuel use policy**

Currently, provincial policy directs that coal-fired plants be used for base load electricity requirements.

Desired outcome

The alternative of using natural gas-fired plants to meet base load requirements should be assessed as one possible means of meeting certain environmental objectives.

J) Issue requiring attention: **The treatment of major capital-intensive projects**

The current regulatory approach to cost recovery concerning capital-intensive projects (such as hydro projects), is a barrier to their consideration in meeting electricity needs.

Desired outcome

Innovative financial and Alberta Public Utilities Board terms should be identified and assessed to make major capital-intensive generation projects financially attractive.

2) Climate change and acid rain

CO_2 and climate change

Carbon dioxide (CO_2) emissions are being raised as a concern in connection with climate change. While thermal generation from coal and gas is currently the most economic option for generating power in Alberta, there is currently no practicable, commercially available technology for disposing of CO_2 produced during combustion.

There are, however, a number of positive steps which can be undertaken so that global warming concerns are addressed responsibly:

- Alberta should negotiate an appropriate federal-provincial CO_2 emission control agreement that is realistic and achievable, recognizing the relative contribution of Alberta and Canadian

emissions to global warming. Such an agreement should ensure that the province's social and economic well-being is not adversely affected.

- An appropriate research agenda developed in concert with industry, universities and governments should focus on achieving greater efficiency in all stages of electrical production, transmission, distribution and use. Suitable measures should be assessed to encourage the development of technologies that capture and dispose of or utilize CO_2.

- Financial and technical support should be made available to developing countries to encourage the transfer of technology to deal with the emission of greenhouse gases.

Acid rain

One of the concerns regarding the emission of sulphur dioxide and oxides of nitrogen is that they may lead to acid rain. The Acid Deposition Research Program (ADRP) reported in 1988 that acid gases were not harming the Alberta environment. The three-year study also said that some areas of the province could be susceptible to acid deposition and suggested monitoring efforts should continue.

Efforts to ensure that acid deposition problems do not emerge should include attention to the principles and regulatory issues noted in this brief. In this way, appropriate and cost-effective measures can be undertaken to prevent acid gas-related problems.

3) Research and development initiatives

Since there is an abundance of low-sulphur, sub-bituminous coal in Alberta, a research agenda should include efforts to enhance the development of clean coal technology. Cost sharing of research efforts and field testing in Alberta of technology developed abroad would enhance clean air efforts in the province. As noted, further efforts are necessary to develop technology to remove CO_2 from combustion processes and find appropriate disposal techniques.

4) Information and educational efforts

Information about the province's environmental status must be communicated to Albertans in a regular, comprehensive and comprehensible fashion. In this regard, the proposed State of the Environment report mentioned in the Alberta Environmental Protection and Enhancement Act is a worthwhile endeavour. Additional use of information gathered by the utility industry about ambient air in the vicinity of plant operations could assist the dissemination of information to the public.

Consumers must have access to useful information that will allow them to make wise decisions that positively affect the environment. Further attention is necessary to coordinate communication efforts by government and industry concerning consumer conservation efforts. Additional attention should also be devoted to incorporating environmental education in school curricula.

A concluding word

This submission has outlined a number of alternative approaches to maintaining clean air in Alberta. In order to pursue technological solutions, conservation-based approaches, alternative energy options or a combination of these and other measures, some changes to the regulatory framework should be thoroughly discussed.

With an appropriate regulatory framework in place, industry, consumers and stakeholders can build on efforts already undertaken to safeguard the environment.

This brief provides a menu for future discussion. The EUPC and its member utilities look forward to participating in further efforts to advance the Clean Air Strategy.

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CU REPROGRAPHICS

SUBMISSION

BY

THE CANADIAN CHEMICAL PRODUCERS' ASSOCIATION

TO THE

CONSULTATIVE PROCESS ON

CLEAN AIR STRATEGY FOR ALBERTA

(CASA)

October 29,1990

The Canadian Chemical Producers' Association (CCPA) represents over 70 member companies producing a broad range of petrochemicals, inorganic chemicals and specialty chemicals. Total output of these industrial chemicals and synthetic resins amounted to approximately $11 billion, of which over 90 per cent came from member companies' operations in Canada. The industry employs about 25,000 persons throughout Canada and is highly trade oriented. Membership is attached at Appendix 1.

GENERAL STATEMENT

The Canadian chemical industry owes it to Canada to behave in an environmentally responsible manner. The Canadian Chemical Producers' Association, on behalf of its member companies, accepts that responsibility and commits to the responsible development, introduction, manufacture, transportation, storage, handling, distribution, use and ultimate disposal of chemicals and chemical products in a manner which minimizes adverse effect on human health and well-being and on the environment.

The merging and interdependence of economic and environmental objectives, considered crucial by the Brundtland Commission, implies that environmental considerations cannot be the sole pre-occupation and preserve of groups of environmentalists, nor should economic considerations be the sole pre-occupation and preserve of groups of industrialists, and nor should all the final decisions be the sole pre-occupation and preserve of groups of government officials and politicians. To proceed in this way means that all parties, environmentalists, industrialists and officials, become excessively protective of their own interests, confrontational vis-a-vis the interests of others and gains towards the objectives are only achieved through regulatory approaches that require intensive enforcement. Such an approach shows no net gain for society and is wasteful of efforts for all parties concerned and leads to growing dissatisfaction, disaffection and even a siege mentality which can only produce negative results for the country.

The countries which will rise above others in the future will be those which will have achieved an orderly transition to a solid, environmentally sustainable, long-term economic development. In order to achieve such an objective, attitudinal change and cooperation on the part of all stakeholders, including government will be essential. The eventual plan of action that will emerge from the

current round of consultations will need to promote:

- o the sharing and merging of specific environmental/economic goals by all parties
- o personal and individual commitment and actions
- o a focus on those problems which are the most crucial, with priorities based on sound scientific principles
- o a focus on solutions which will have the desired impact, as defined jointly by the interested parties
- o solutions which rely on a balance of personal initiative and a regulatory framework.

When stated as general principles, the above have a tendency to sound like motherhood statements. However, their application to specific issue areas will be crucial to making progress towards the overall objective of environmentally sustainable economic development.

It will be the role of the Provincial government to ensure that, as it evolves its consultation and action plan, it does so in a manner consistent with the above principles. It should also seek the commitment of the interested parties to these same principles.

o <u>The Role of CCPA</u>

For its part, The Canadian Chemical Producers' Association commits itself to acting in line with the principles enunciated above:

1. The CCPA and its member companies through their proactive Responsible Care initiative are committed to raising awareness about environmental sustainability and promoting responsible handling of chemicals throughout their life cycle. This applies not only to their operations, but also to that of others who handle these chemicals. Responsible Care consists of:

    - o individual commitment to guiding principles by CEOs on behalf of their companies
    - o a set of codes of practice screened by a group of community activists and endorsed by the full membership
    - o mutual help and sensitization in achieving conformance amongst association members
    - o public scrutiny of both process and progress

This initiative has been recognized as a responsible and positive approach by both Environment Canada and the United Nations Environment Program.

2. The CCPA and its member companies are committed to identifying issues and their solutions in a cooperative partnership with all other interested parties. The CCPA has clearly demonstrated this commitment through positive participation in consensus building consultations ranging from development of the Chemical Hazard Regulations through to input into the Environmental Law Enforcement Report and membership of the CASA Advisory Group.

o <u>The role of Provincial Government</u>

For its part, the provincial government must commit itself to:

1. Meaningful consultation involving all interested parties. Such consultation, to be meaningful, implies:

   o early consultation on defining the problem

   o ongoing consultation on identifying options for effectively solving the problems as well as the impacts on the various parties involved

   o final consultation on the legislative and regulatory instruments that may be required.

2. Promoting a partnership or consensus approach as the preferred route for consultation, along the lines of the Niagara Institute consultation protocol which had been agreed to by all parties.

3. Using legislation and regulations as safety nets to ensure an acceptable level of results by all, but placing increasing reliance on voluntary actions by non-government elements. This implies that government should give moral support to pro-active initiatives of the private sector.

4. Interdepartmental coordination which effectively integrates and balances the environmental and economic aspects of the issues and their potential solution, in order to achieve a net positive gain for society as a whole. Not to do must imply outright acceptance of sub-optimal results.

o <u>The role of Environmental Groups</u>

For their parts, environmental non-government organizations must commit themselves to:

1. Raising the environmental awareness of the other parties on an ongoing basis in a manner which will promote a more cooperative and less adversarial approach to resolving issues.

2. Support multi-partite partnerships aimed at identifying issues and their nature as well as integrative solutions which meet the test of environmentally sustainable development.

3. Assist private sector efforts in developing proactive initiatives aimed at effectively solving the issues.

As stated earlier, the nature of issues in the environment area bring to focus a variety of societal objectives. It is incumbent on all interested parties to seek integrated solutions as envisaged by the concept of environmentally sustainable economic development proposed by the Brundtland Commission. Failure to do so will undoubtedly result in failing our children in their long-term economic, environmental and health well-being.

THE INTERNATIONAL CHALLENGE

We particularly wish to discuss the challenges facing Alberta within the international context. This international element represents a challenge both in terms of economics and the environment.

Globalization has been the order of the day for many industries, and even more so, for the chemical industry where the test of severe competition is having to be met in both domestic and international markets. Approximately one third of all Canadian production is destined for exports while a similar percentage is imported to meet Canadian demand. Alberta does not have many competitive edges over production in other countries, in fact, availability of resources is one of the few natural ones. On the other hand, market size does create disadvantages. The balance between these is delicate.

The concept of environmental sustainability does bring focus on intergenerational equity which means an appropriate

balance between today and tomorrow. Our children will not thank us for having created economic chaos for them any more than they will thank us for having created environmental chaos. That is why the words "orderly transition" are so important in the overall objective proposed earlier.

There can be no doubt that our actions and operations must be carried out with environmental awareness. To do otherwise is bad business. Our Responsible Care initiative is noted as a credible effort in this direction. We recognize equally that pollution prevention pays off economically in the long-term. Short-term dislocations could result, however, in losing our competitiveness and not being able to capture the long-term economic benefits for Canada.

Another aspect is important to consider here. If the Albertan regulatory framework is such that certain products can no longer be made competitively in Alberta, the products will still be made somewhere in the world for Albertan and Canadian consumption unless Albertan and Canadian demand changes. In particular, the products could be transformed into final products outside Alberta and Canada and be imported having bypassed the full Albert and Canadian production cycle and the regulatory regime. As an example, paint ingredients and paint could be subject to regulatory controls which make it uneconomic to make or even use them in producing Canadian cars. If other countries do not follow suit, it will be much easier and cheaper to import finished painted cars into Canada, if people still demand them.

This leads to concern about the way in which leadership by Alberta should be exercised on environmental issues and their solutions. Leadership can be practised by taking unilateral action or it can be exercised by prodding everyone forward. The former can create serious dislocations and possibly curtailment of Albertan operations, creating economic disorder while the latter can bring about necessary changes in a smoother transition with considerably more impact.

It is recommended therefore that Alberta demonstrate environmental leadership by forming partnerships with affected industries and interested environmental groups to obtain consensus on environmental issues. Hence a Provincial viewpoint can be presented to the rest of the Country through intergovernmental agencies (such as CCME) and be considered when arriving at a Federal viewpoint for inclusion in international agreements. This assumes that appropriate consultation will have taken place within both Alberta and Canada along the lines described in the general statement section to achieve agreed solutions.

The Canadian Chemical Producers' Association commits itself to play a positive role within such initiatives and has, in fact, displayed international leadership through its Responsible Care initiatives which it has promoted internationally. It is now being adopted by numerous other countries including the U.S., Australia, France and the Netherlands. This leadership has recently been given recognition by the United Nations Environment Program. A number of its companies have also participated actively with government in international activities such as development of the Montreal Protocol and ongoing work in the area.

The remainder of this presentation addresses specific issues under the following headings:

- Better Science
- More Information about the Environment
- Education
- Legislation and Regulation
- Economic Instruments
- Strengthening Partnerships
- The Health Dimension
- Global Warming
- Ozone Depletion
- Air Quality and Toxic Air Pollutants

SPECIFIC ISSUES

The basic principles discussed in the foregoing sections provide the necessary underpinning for achieving appropriate decisions on specific issues. There are therefore recommended as the privileged approach to dealing with any issues that will be discussed herein.

BETTER SCIENCE

Considerations

- The scientific community has a responsibility to Alberta to provide objective consensus of scientific realities as an appropriate basis for the rest of the province to make judgements. It must assist with the definition of worthwhile targets as well as facilitating innovative solutions. To perform this role adequately it must seek ways of bringing together representatives from government, academia, ENGOs and industry. We must recognize that "good science" may not exist in some areas. We must still use it however to the maximum extent possible to manage uncertainty.

- While CCPA can support the need for an increased commitment to environmental science and technology, there is an equal need to develop criteria whereby priorities can be established. Some of these could be:

    - urgency created by impacts
    - seriousness of the impacts
    - dove-tailing with federal and international efforts

  It will be important to remember that more science is not necessarily better science.

- There is a need to develop further excellence in toxicology in Alberta. At the moment this area is not adequately coordinated nor are there sufficient resources available to produce required studies. Additionally, there is a need to increase the supply of toxicologists.

  The concept of "Networks of Centres of Excellence" as developed by Industry, Science and Technology Canada would appear to have validity for the toxicology area, bringing together, as it does government, academia and industry in a focused and coordinated manner. There is a need however to develop strong nodes around which the coordination will be established. Earlier effects were promised industry support, notably the establishment of

the Guelph/Toronto Canadian Centre for Toxicology and a proposal for a Network of Centres of Excellence in Toxicology. Neither of those have received federal government support.

Industry has offered its support on the condition that:

- o governments also confirmed their support in order to ensure that the public would perceive the operations as objective.

- o there would be an overall Canadian approach to get away from duplication and regional rivalries, and provide the necessary critical mass.

Recommendations

Government should establish an advisory board or similar operation under a single lead agency, to establish clear priorities for funding scientific research. Such a board should include representatives from governments, ENGOs, academics and industry. Emphasis should be on the practical application of science.

MORE INFORMATION ABOUT THE ENVIRONMENT

Considerations

- o There is already much information available about the environment. In fact, a considerable amount of it is confusing and contradictory. More information therefore might simply compound the problem. Any effort in this area should be directed towards increasing the objective interpretation of available information. In order to do this, the exercise could be fed by multi-partite scientific groups as described in the previous section on "better science". Additionally, the presentation of the information is also crucial to creating proper and balanced understanding of the issue. A multi-partite communication group could advise on how best to communicate the information.

- o It is recognized that environmental information must be available to all Albertans. Rather than spending much effort in bringing everything together in a centralized system, it would be better to focus on assembling information wherever information on various subjects is already available in Alberta and develop the means of accessing that information, whether electronically or otherwise.

Recommendations

- Before proceeding further, a task force should be assembled to assess what institutional changes are necessary to ensure how to better disseminate information, how to identify gaps in information and how to fill gaps in an objective manner. The aim should not necessarily be more information but better information. Such a group should consist of both the scientific community and communicators, and have representatives of governments, ENGOs, industry and the media.

- The Government should concentrate on developing a system to access available information rather than develop a centralized source. In addition, support should be given to the efforts of the Canadian Chamber of Commerce in developing an Environment Bureau to facilitate access to information for smaller businesses.

EDUCATION

(The comments are more fully developed at Appendix 2.)

Considerations

- The educational system must provide a balanced approach to the presentation of information.

- Utilize existing partnerships or instruments rather than creating new bureaucracies.

- Give recognition to other channels of information, such as the media.

- Build on the Green Plan recommendation of "good decisions require good information".

Specific examples of how the CCPA is involved include "Knowledge of Environment for Youth" (KEY) Foundation (formerly SEEDS Ontario) and the Foundation Riou-Delorme in Quebec. These efforts focus on providing a balanced information background for teachers in primary and secondary schools, and supporting the development of objective classroom-ready material. The CCPA is also supporting the School of Journalism at the University of Western Ontario in establishing an Institute for Environmental Journalism.

Recommendations

- Environment studies should be established at all school levels
- Focus on improving the competence and objectivity of those involved in various education processes, including teachers, media
- Provide multi-partite support for development of curriculum material for use in the classroom through existing mechanisms wherever possible.
- Encourage universities to add environment to the curriculum of their schools of business and journalism.

LEGISLATION AND REGULATION

Considerations

- Industry needs a clear set of rules on what is expected of it in environmentally-related matters. Such rules can be implemented through many instruments (regulations, economic and even self- developed). The balance should be governed by consistency, effectiveness and efficiency in reaching agreed objectives.
- While multi-partite consultation processes, as described in the general statement section of our paper, may be more time consuming at the outset, results are obtained more quickly because of a buy-in by all the parties who participated.
- The government has a long list of tools available to ensure compliance. The first efforts should always be focused on educating and informing, aiming at voluntary compliance thereby lessening the pressure on enforcement activities.
- Generally, the federal and provincial governments have sufficient laws to deal with environmental matters. Regulations must be justified on a case-by-case basis.
- It is imperative that a proper balance between enforcement and compliance is maintained. Enforcement and prosecution should be reserved for those cases of deliberate environmental damage. In addition, the abatement and enforcement functions should be kept separate.

- Government should ensure that if it sets out on a regulatory development course in a certain area, it has adequate resources to carry it through. All too often, insufficient resources have resulted in inadequate identification of the problems, incomplete review of available options, inadequate assessment of the consequent impacts. Senior management should require a full plan of the process before starting it and discuss it with the other interested parties.

- While the objective of streamlining regulation development is one that must be pursued, there can be no short-cut. As noted in our general statement, the integration of environmental and economic considerations does mean that the optimum reconciliation must be achieved. There are potentially difficult impacts on both sides of this equation and all must be identified along with the best options. The consultation process spelled out is the only one that will allow the best results and full buy-in by all the parties. The process will streamline itself as the various involved parties move along the learning curve. Finally, in terms of accessibility, the various interested parties, such as industry or environmental groups, should be encouraged to try to develop consensus within their own group area in order to facilitate the consultation process.

ECONOMIC INSTRUMENTS

(The comments are more fully developed at Appendix 3.)

Considerations

- CCPA concurs that economic instruments can be an effective complement to, and in some cases a substitute for, environmental regulation, but that further work is needed to assess fully the merits of using economic instruments. Economic instruments can be used as an incentive to achieve compliance but there must be clear standards and a reasonable timetable set in advance.

- CCPA believes that in deciding whether to use economic instruments to complement or substitute for environmental regulation, there should be a major focus on what mechanism will be the lowest cost, most equitable, and economically efficient to administer.

- CCPA believes in the basic principle of "polluter pay".

Economic instruments therefore should not detract from this principle nor should their scope significantly distort competitiveness between individual companies.

- The use of economic instruments should not conflict with the simplification of the tax system and the avoidance of dedicated or specific taxes. Such taxes have a tendency to remove specific expenditure programs from the normal discipline of overall government expenditure prioritization exercises and on the other hand, develop pools of funds which are dormant for some time and may be diverted to other purposes.

- The incidence of any economic instrument should minimize side effects and achieve its objective, as agreed in multi-partite consultation, in the most efficient manner.

- Alberta is not an isolated province nor is its industry. This is elaborated in the section on the "International Challenge". In examining the feasibility of using economic instruments, the impact on international competitiveness must be taken into account, and this should be minimized. Otherwise, unless demand patterns change within Canada, all that will be achieved will be a transfer of production to other provinces and countries and imports of final products. However, we may no longer have the money to pay for them because of lower economic activity.

Recommendation

- <u>There is need for concerted multi-partite consideration of economic instruments, their feasibility, impacts and effectiveness.</u>

STRENGTHENING PARTNERSHIPS

Considerations

- In the "general statement" section of this paper, CCPA stated the need for government being a catalyst for cooperation rather than confrontation. Optimum merging of environmental and economic objectives for Alberta can only be achieved by early and ongoing consultation with all interested parties towards consensus building.

- Internationally, Canadian unilateral solutions may harm

Canada's economic performance while having little beneficial impact on the global problem. The Canadian government must seek to catalyze international action rather than acting unilaterally. CCPA would support greater Canadian participation in international institutions but with Canadian positions in such forums only being taken after multi-partite consensus within Canada.

- Coordinated federal/provincial action is absolutely essential if economic development is to be sustained within environmental imperatives. This co-ordination must include working towards national standards which are consistent, and the streamlining of assessment and approval processes in a "one-stop shopping" approach. Industry must be able to react quickly to development opportunities, otherwise, because of globalization, such opportunities will be captured by other countries. We are not stating that assessments be forgone but rather that they be done expeditiously.

Recommendations

- The provincial government should promote ongoing forums where all interested parties can meet and build trust and understanding on the subject of environmentally sustainable economic development. The National Round Table and its provincial counterparts, as well as the Niagara Institute approach, should be considered as valid models, but to be successful more participants m all parties must become involved in building trust and creating consensus.

THE HEALTH DIMENSION

Considerations

- The CCPA, in the guiding principles of Responsible Care which are signed by each member company CEO as a condition of membership in the association, states its commitment that operations shall not present an unacceptable level of risk to employees, customers, the public and the environment. In addition, CCPA assumed a leadership role amongst industries in developing the Workplace Hazardous Materials Information System (WHMIS). CCPA wishes to restate its commitment to the health dimension and to participate in the development of specific initiatives to address the links between environment and health.

- Fundamental to the health dimension is the need to

recognize that the effects of pollution are a function of dosage, that is, to both the toxicity of the material and the extent of exposure to the material. The toxicity of a material is an inherent property and cannot be changed. These characteristics are being defined to the degree required by the CEPA regulations for both new and existing chemicals. The risk presented can therefore only be controlled by reducing the level of exposure. It is important to ensure that all statements about the potential effects of chemicals be made in terms of their risks and not simple their toxicological properties.

GLOBAL WARMING

Considerations

- Reducing scientific uncertainty must be the primary objective at this time. Such a consensus appears likely to emerge this year in reviews of the Intergovernmental Panel on Climate Change work group reports and at the World Climate Conference in November. Canadian and international actions should await their results.

- Global warming, as the name implies, is a global issue which requires global solutions. Alberta, by itself, cannot significantly contribute to the solution since Canada accounts for only about 2% of the world's emissions. It's biggest contribution should be in catalyzing international action, commensurate with any scientific consensus achieved later this year.

- International targets for emission reductions are being considered. Under such an umbrella, it will be important to recognize that the level of the playing field is not the same for all countries. Percentage reductions, as an example, for Eastern European countries and their industries, will be more easily achieved and less disruptive than the same percentage reduction applied to Alberta, and its industries. Even within Albertan industry, some sectors have already demonstrated leadership in improving energy efficiency. The chemical industry has been in the forefront of these efforts since inception of the program, with an increase in efficiency above 40 percent. Further improvements will only be achieved mostly through building totally new plants.

- Alberta should focus on a program to reduce carbon

dioxide emissions by pursuing strategies that are beneficial in their own right, such as support for clean technologies, and specific energy efficiency measures.

- Unilateral actions, as noted above, will not contribute significantly to the global solution, and yet may create severe economic pressures on the competitiveness of Albertan industry. Imposition of regulations or use of domestic economic instruments should only be implemented once the net improvement in emissions will have been demonstrated and once the impact on Albertan industry and on the Albertan public will have been clearly understood by the affected parties. Of particular importance will be the differential impact on competitors outside of Alberta. For example, fuel for the transportation of chemicals could make it much easier to ship from U.S. border towns than from Albertan industrial sites.

- The Albertan petrochemical industry depends extensively on petroleum and natural gases for its raw materials. If regulations or economic instruments such as taxes are considered essential to combat global warming, feedstocks should be excluded from all such measures.

OZONE DEPLETION

Considerations

- CCPA supports internationally coordinated actions to eliminate the production and use of CFC's as soon as possible. In fact, members of the Canadian chemical industry have shown themselves to be in the forefront of studies and actions to bring about the required changes.

- Specific regulatory initiatives to prohibit particular uses of CFC's should not be undertaken until effective substitutes can be found and are commercially available in adequate quantities. Such initiatives should be coordinated across the country.

- If alternative products are to be introduced and promoted, potential producers will have to receive acceptable assurances that they will be able to produce long enough to recover their initial investment.

AIR QUALITY AND TOXIC POLLUTANTS

Considerations

- Recent studies are showing that emissions of VOC's from the chemical industry are much lower than had originally been expected. International conventions that do not take this into account could unfairly penalize the industry for already being environmentally responsible.

- There is increasing concern that long range transportation is the most important input of toxic chemical, therefore an effective Albertan solution can only happen in conjunction with Canadian and U.S. actions.

Recommendations

- Urge the Federal Government to negotiate a transboundary air quality accord with the United States and develop a Parallel control program.

- Insist that the basis for any international protocol on emissions be based on emission standards as opposed to simple percentages.

APPENDIX 1

CANADIAN CHEMICAL PRODUCERS' ASSOCIATION

LIST OF MEMBERS

Akzo Chemicals Ltd.
Albright & Wilson Americas
Alby Chlorates Canada Inc.
Alcan Smelters & Chemicals Ltd.
Alchem Inc.
Alkaril Chemical Ltd.
Allied-Signal Canada Inc.
Ashland Chemicals
ATKEMIX Inc.
ATOCHEM North America
BASF Canada Inc.
H.L. Blachford Ltd.
Borden Packaging & Industrial Products
Canadian Occidental Chemical Group
Carbochem Inc.
Carlew Inc.
Celanese Canada Inc.
Chatterton Petrochemical Corporation
Chinook Chemicals Company
CIBA-GEIGY Canada Ltd.
Commercial Alcohols Limited
Courtlands Canada
Cyanamide Canada Inc.
Daishowa Chemicals Inc.
Dow Chemical Canada Inc.
Du Pont Canada Inc.
Eka Nobel Canada Inc.
Esso Chemical Canada
Ethyl Canada Inc.
G.E. Plastics
General Chemical Canada Ltd.
B.F. Goodrich Canada Inc.
Hart Chemical Limited
Henkel Canada Ltd.
Hercules Canada Inc.
Himont Canada Inc.
Hoechst Canada Inc.
Huls Canada Inc.
ICI Canada Inc.
Kemtec Petrochemical Corp. Inc.
Kronos Canada Inc.
Lubrizol Canada Limited
MARSULEX Inc.
Monsanto Canada Inc.
Nacan Products Limited
National Silicates Limited
Nitrochem Inc.
Noranda Sales Corporation Ltd.
NOVA Corporation of Alberta
Ocelot Chemicals Inc.
Oxychem Canada Inc.
PPG Canada Inc.
Pacific Industries
Petromont Inc.

Pigment & Chemical Inc.
Proctor & Gamble Inc.
Raylo Chemicals
Recochem Inc.
Reichhold Limited
Rhone Poulenc Canada Inc.
Rohm & Haas Canada Inc.
Shell Canada Chemical Company
Stelco Inc.
Sulco Chemicals Limited
Surpass Chemicals Limited
Tioxide Canada Inc.
Union Carbide Canada Limited
UNIROYAL Chemical
Welland Chemical Ltd.
Witco Canada Inc.

1 May 1990

APPENDIX 2

DISCUSSION PAPER

EDUCATION - THE THIRD REQUIREMENT

As stated in the document the main purpose of education regarding the environment is as one of the strategic elements leading to better decision-making.

Although often treated as a separate element, education cannot be treated in isolation from the various flows of information which create the sum total of one's knowledge and attitudes.

It is a major component but it is not the only source.

The general inference of education is that it is aimed at those in attendance at academic institutions. Although the main direction of this response will follow this path it must however touch on those other sources of information which contribute to the individual's overall awareness and knowledge of matters relating to the environment.

In addressing this transmission of information it is important to recognize that the understanding and attitudes formed are a function of the information itself, the source of the information and the channels through which the information moves.

In addition to being the agency by which information moves, the educational system must provide the basic skills by which new information can be acquired, assimilated, digested and enhance the knowledge of the individual.

The long range purpose of the educational process, although described as "an environmentally educated population which will demand that all sectors of society meet a high level of environmental responsibility" is more than that.

A public which is better educated with respect to the environment is able to:

(a) make more environmentally sound personal choices
(b) better evaluate and support proposed legislative and regulatory initiatives
(c) develop an environmental ethos which ultimately pervades all sectors of society
(d) better evaluate the flow of environmental information as it emerges

Developing the skills necessary to process new information as well as cope with the current plethora of data, conflicting views and rhetoric surrounding the environment requires a balanced approach to the presentation of information.

The principle of balance is one which must permeate the total process of information flow. The second fundamental principle is to utilize existing partnerships to address the

development of environmental curriculum rather than creating new bureaucracies.

In looking first at the area of information one must do so within the overall context of improved decision making and the other elements which are key to the process.

The quality of the end result will obviously be first a function of the quality of the input. To quote, "good science is essential for good environmental policy and sound regulation. It is indeed the process by which existing situations can be described, progress is measured and new problems identified".

The quest for better science leads directly to the second key factor - which is more information about the environment. The caution to be made here is that more is not necessarily better. As stated, "good decisions require good information".

This element is as crucial to the legislative and regulatory process as it is to the decision making process. The knowledge upon which decisions are based may be presented in different forms depending on the nature of the decisions to be made. The essential fact is that the information must be the best that is attainable and as balanced and objective as possible.

Where there is a difference between theory and fact this must be clearly identified, the tenuousness of the theory clearly understood and the reliability of the factual information properly established.

In many cases the authors of theory are accorded a higher degree of credibility than are the sources of fact. There must be no effort to subvert the transmission of theory but the ability of the public to deal with these potential conflicts must be improved. There ability to evaluate both the source and the nature of the information must be a primary goal of the educational process.

In looking at the educational process the first requirement must be to achieve both competence and objectivity on the part of the educators. The second requirement is to have this competence transferred to those being educated.

In an area as contentious and politically sensitive as the environment it is crucial that those being educated are capable of forming their own opinions as opposed to having the opinions of others induced (or imposed) on them.

Environment should not be an instrument to be used in the pursuit of ideological goals but as a goal unto itself.

Earlier in this paper it was suggested that a holistic approach be taken with respect to the information process.

If educators are considered part of the information process so are the media. This would suggest that in addition to educating the educators to deal with the subject of the environment in a balanced way, so should those engaged in the professional communications field be better equipped to provide a more balanced and objective presentation of information.

The first priority must be to improve the efficiency or competence of those in control of the flow of information i.e. educators, practising media professionals, those "in-training". As the system evolves and improves, this level of environmental competence will find its way into those involved with the creative communications process.

The second priority is to develop the information which will be used in the classroom setting. Since the formal inclusion of environment in the school curriculum must be with the agreement of the provinces, the development of environmental curricula will be subject to a more disciplined process than that which exists at present.

It would appear that the current flow of environmental curricula is driven primarily by the self-interest of its authors. Each stakeholder has the inherent belief that its materials are an accurate presentation of the situation. The result is a range of materials of considerably disparate quality in presentation and content.

The first priority must be an agreement that environment or environmental studies become a formal component of the primary and secondary school curriculum.

The second must be the upgrading of the teachers so they possess the necessary balanced background to participate in the development of appropriate curriculum of a balanced nature.

The third step must be the production of the supporting curriculum materials which will achieve the desired balance.

In the case of the first priority there appears to be sufficiently widespread concern regarding the environment that acceptance of it as a curriculum subject is virtually a given

In the case of the second and third elements several efforts currently exist which bring many of the stakeholders together in a cooperative effort to address the development of curriculum material on energy and the environment.

Specifically these fora are Society, Environment and Energy Development Studies (SEEDS) which dates back to the mid-seventies as an effort to improve the level of public understanding of energy matters.

Modelled after it and following the same processes are the Canadian Environmental Education Association and The Foundation Riou-Delorme.

It is recommended that the government examine these existing organizations with a view to determining the possibility of utilizing them to develop the desired curriculum materials. The efforts of these organizations can be significantly advanced and enhanced with proper government support. Thus far the financial and human resourcing has been provided essentially by the private sector! Recognition by governments of these efforts and increased resourcing would create significant progress toward achieving improved environmental literacy.

The concept utilized by all three organizations is to utilize teachers with assistance from industry and the environmentalists to develop environmentally oriented curriculum material.

The starting point, however, involves the provision of a forum in which teachers have access to various viewpoints and environmental information. These fora bring educators, environmentalists, media representatives and industry together with the purpose of improving their ability to deal with environmental issues.

After this has been accomplished the educators determine the subject areas and the aspects to be addressed. Using the assistance of industry and environmentalists as they see fit the curriculum materials are subsequently developed.

This initial effort at an environmental educational partnership, although in a relatively embryonic stage, is sufficiently well advanced to assist both the federal and provincial governments to achieve their environmental educational objectives.

Although the initial impetus came from the private sector, the essential principle guiding these efforts is that the materials thereby produced possess the highest possible degree of integrity. This means they must provide an opportunity for exposure to the issues as viewed by all the stakeholders. It is through this relatively balanced learning process that the environmental literacy of the individual student is enhanced.

Earlier reference was made to the role of media in the process of environmental education.

It is recommended that governments encourage universities to add environment to the curriculum of their courses in journalism.

There is an effort currently underway involving the University of Western Ontario and industry to create an Institute for Environmental Journalists.

Its objective is to provide an opportunity to improve the reporting profession's ability to deal with environmental matters.

Similar institutes dealing with law and economics already exist and are being used as the model in developing a similar concept for environment.

Recognition of this effort by governments and direct support would greatly expand participation by the media, environmentalists and industry.

Again, the underlying principle is to acquire an ability to achieve balance but to use existing structures to address the issue.

Permeating the proposed methodologies is a recognition that the stakeholders exist in a common environment. These same stakeholders have demonstrated a shared concern for the environment and both a willingness and specific examples in which the shared concerns have transcended narrow self-interests. There are a significant number of examples at the national, provincial and local community level where these stakeholders have worked cooperatively to achieve a mutually agreed upon set of objectives.

The various efforts referred to are specific examples of this new found spirit of concern and cooperation.

APPENDIX 3

ECONOMIC INSTRUMENTS

Background

The Federal Government has stated that it believes that economic instruments may be an effective complement to, and in some cases, a substitute for, environmental regulation. Because of the limited experience in Canada and other countries with such instruments, the Government has indicated that further work is needed to assess the merits of these instruments as a means of achieving environment objectives.

It, therefore, stated in its discussion paper "The Green Plan":

> Following the release of The Green Plan, the Government intends to initiate a detailed discussion of the advantages and disadvantages of economic instruments, involving individuals, environmental non-governmental organizations (ENGOs), business and the university community.
>
> Further, there may be a need for a special program to stimulate applied research into the application of economic instruments to environmental problems - perhaps through a specialized university network.

Considerations

In assessing whether to use economic instruments and/or command and control regulations and standards to achieve environmental objectives the Provincial Government should give careful consideration to the following points:

- the "polluter pays" principle should be upheld;
- environmental problems are caused by Albertans at all levels of society;
- solutions will require large costs, e.g., Informetrica has estimated that adopting best environmental technology will cost $84 billion capital expenditures and $17 billion in operating expenditures by the end of the decade;
- the magnitude of these costs must be recognized up front before deciding who should bear them and what mechanism should be used to meet agreed environmental objectives;
- there should be a major focus on what mechanism would be lowest cost, most equitable, economically efficient and lowest cost to administer;
- the use of economic instruments should not conflict

with one of the key objectives of the Federal Government's recent tax reform legislation - the neutrality of the tax system and the avoidance of dedicated or specific taxes.

Cleaning Up Existing Dump Sites

- o responsible party should pay;
- o if responsible party cannot be identified or is insolvent then society at large should pay for clean up through broad based taxation;
- o responsible party should have to pay when responsible but not when it is NOT responsible;

Curtailing Current and Future Pollution

- o the responsible party or polluter should continue to be responsible;
- o CCPA member companies are making environmental considerations part of business planning process and assess environmental impacts of projects before they proceed;
- o CCPA companies must also adopt corporate environmental policies according to Responsible Care and they are encouraged to recycle and reuse and develop products which are as compatible with environment as possible;
- o they recognize that paying attention to the environment is also in the best interests of the company;
- o although co-operative approaches which seek mutually advantageous solutions are best, reduction of pollution is also being driven by tighter and tighter government regulations;
- o the effectiveness of regulations should not be underestimated - governments have ensured that the penalties associated with non-compliance are extremely high;
- o so long as the regulations are appropriate and developed through multi-partite consultation, are necessary, economically efficient, cost effective, equitable and allow sufficient time for compliance, CCPA believes they should be an integral and usually necessary part of a system which requires the polluter or responsible party to pay;
- o since environmental problems do not respect boundaries

the regulatory approach must be Coordinated among jurisdictions, both within Canada and internationally;

- o failure to do so would mean that material and global improvements in the environment would not be achieved, and the costs could be imposed on Albertan companies;

- o potential for regional dislocation in Canada as some plants close in response to more stringent regulations in some provinces but not others.

Use of Economic Instruments to Achieve Environmental Goals

- o CCPA agrees that regulation alone may not be a complete answer and that the use of some economic and financial instruments should be carefully assessed to see if they might be issued in conjunction with or in place of regulations and standards to achieve environmental objectives;

- o because of the lack of experience with economic instruments in both Alberta and Canada as well as elsewhere and a concern that they will frequently be less economically efficient, more costly to administer and less equitable than regulation or standards CCPA feels that economic instruments must be carefully assessed before making any decision about whether to use such instruments to achieve environmental objectives in Alberta;

- o some of the questions that need consideration are:

Environmental Taxes

- o what would be the impact on international competitiveness;

- o what would be the purpose of the environmental tax - to reduce consumption or pay for cleanup?

- o if to reduce consumption, would a tax be effective at reasonable levels when demand for the produce (e.g. energy) may be quite inelastic, would the tax then be just a source of new revenues;

- o would not a tax of this type be inconsistent with the federal government's goals of tax neutrality and the avoidance of dedicated taxation?
- o if government taxation is to pay for clean ups, should the tax program recognize the

polluter pays principle and revenues only be used where responsible parties cannot be identified or are insolvent;

- should such a tax be broadly based, for example, through a sales tax, in order to recognize the societal responsibility for cleanups and avoid penalizing those who are already paying to cleanup as responsible parties;

Economic Instruments such as Effluent Charges, User Charges Transferrable Emission Rights, Deposit Refunds

- would they be consistent with the polluter pays principle;
- would they, in effect, be a form of a dedicated or specific taxation which punitively hit companies which were in compliance with accepted regulations and standards while giving other companies a "licence to pollute";
- is there evidence to show they are more environmentally effective, economically efficient and as equitable as regulations and standards;
- could they be set at rates which would be effective but not impair international competitiveness;
- would they be easy to administer at low cost;
- could they be implemented effectively across the three levels of government;
- would they impose an economic burden which is fairly distributed;
- would they provide sufficient incentives to result in prevention;

Grants, Loans and Other Financing Measures

- would there be a way to design these instruments so they would be consistent with the polluter pays principle and the need to be neutral in providing government assistance to the private sector;

- would they involve the government in competition with private sector financing;

- would the costs be too high in relation to the results achieved;

- could they be applied so as to not unfairly differentiate between individual companies;

- would they involve relatively complex interaction with the tax system;

CONCLUSION

In assessing whether to use economic instruments to complement or to substitute for environmental regulations, it is essential that:

1. the polluter pays principle be maintained.

2. the choice be based on the mechanism which is found to be the lowest cost, the most equitable, economically efficient and the lowest cost to administer.

3. the choice should minimize the potential for conflict with other government policies.

NATURAL GAS AND THE ENVIRONMENT

A POSITION PAPER PRODUCED BY:

THE CANADIAN GAS ASSOCIATION

AND

THE ONTARIO NATURAL GAS ASSOCIATION

June, 1990

INTRODUCTION

This report tables the position of the Canadian Gas Association and the Ontario Natural Gas Association as it relates to environmental degradation. While natural gas has an increasingly important role to play in combatting all pollution - including the problems of solid wastes, water pollution etc., the paper deals specifically with problems of atmospheric pollution.

The Canadian Gas Association (CGA) is the national trade association for Canada's natural gas industry and has over 500 members, including production, transmission, and distribution companies, manufacturers of components, equipment and appliances, pipeline contractors, brokers, supporting service companies and private individuals.

In addition to the normal trade association activities, CGA is accredited by the Standards Council of Canada to sponsor the writing of national standards for the industry, and to certify and test gas appliances and equipment.

CGA is also actively involved in an industry-sponsored research and development program to develop natural gas vehicle technology applicable to cars, light and heavy duty trucks, and urban transit buses. An affiliate of CGA, the Canadian Gas Research Institute (CGRI), carries out gas industry-related research projects selected by its members.

The Ontario Natural Gas Association (ONGA) is the provincial voice of the natural gas industry. With over 300 members drawn from distributors, producers and manufacturers of gas appliances and equipment it represents the industry's collective views in public forums.

EXECUTIVE SUMMARY

To the extent that energy is essential to our existence, and that fossil fuels are a major contributing factor to atmospheric pollution, it is axiomatic that maximum efficiencies in energy use be sought while the longer term search for non-polluting energy sources continues.

In the interim, natural gas will play an increasingly important role in the fight against environmental degradation. The use of natural gas directly with or in place of other fuels in residential, commercial, industrial and transportation application provides reduced environmental impact in two ways:

- The process is frequently more efficient, so that total energy use is cut.

- When energy is supplied in the form of natural gas, pollutant release per unit of energy is less.

Natural gas is the least carbonaceous of the fossil fuels - it is therefore the least polluting. In the context of atmospheric change some of its inherent advantages are:

- Taking into account all steps in the full fuel cycle, natural gas contributes less to global warming.

- Natural gas combustion produces no sulphur dioxide (though a small amount of sulphur dioxide is released during the gas processing stage); it therefore contributes much less to acid rain than do the other fossil fuels.

- Natural gas does not contain substances which erode the ozone layer.

- Natural gas combustion produces fewer nitrogen oxides and complex hydrocarbons and therefore by itself contributes less to photochemical smog.

The beneficial effect of increased use of gas, directly with and in substitution of other fossil fuels, will be felt in its application in all market sectors - industrial, commercial, residential and transportation. In the process, growing markets will stimulate gas exploration and development activity, assist economic development, and improve Canada's energy security.

ENERGY AND THE ENVIRONMENT

While there are no quick and easy solutions to the environmental concerns currently before us, it is obvious that they require action. What kind of action is under global scrutiny, but more prudent use of energy resources is considered by many to be a major step in the right direction. Since human initiative helped create the problem, our collective intelligence is being challenged to create and implement the solutions. Full-scale efforts to conserve energy and to use it more efficiently will help. So will the development of non-polluting energy sources, though it will be some time before the benefits of such measures are felt.

Energy is essential to our existence; we need it to fuel our economy and heat our homes. But no form of energy is entirely benign. The fact is that producing, transporting and using energy affects our environment. Finding ways to minimize the impact is of increasing importance to government, industry and consumers. It's a vital and intricate task that the scientific community in Canada and around the world is addressing.

While natural gas may not be the ultimate "environmentally friendly" fuel, it does have an increasingly important role to play in combatting pollution. By all measures -- air emissions, solid wastes, water pollution and water consumption -- natural gas is an environmentally desirable fossil fuel:

- Taking into account all greenhouse gases and all steps in the fuel cycle, natural gas contributes less to the greenhouse effect than do the other fossil fuels.

- Natural gas when utilized does not contain substances which erode the ozone layer.

- Photochemical smog is produced by releases of nitrogen oxides and complex hydrocarbons. Natural gas combustion produces fewer of these hydrocarbons and therefore contributes less to photochemical smog.

- Natural gas combustion produces no sulphur dioxide; it therefore contributes less to acid rain than do the other fossil fuels.

ATMOSPHERIC CHANGE

1. Greenhouse Effect

The threat of global warming ranks as perhaps the foremost environmental concern today. Many scientists believe that the average earth surface temperature will rise in response to higher concentrations of carbon dioxide and other constituent gases in the atmosphere. The regional repercussions of climate change could be serious.

The atmosphere readily transmits radiation from the sun to the earth's surface. However, the atmosphere is not completely transparent to the longer wave energy reradiated by the earth's surface. The result is the beneficial greenhouse effect which exists now and which has existed for millions of years.

Population growth, increased industrial and agricultural activity, and increased energy demand all tend to increase the concentrations of atmospheric gases. The result could be an undesirable heightening of the present beneficial greenhouse effect.

The atmosphere is made up of 78% nitrogen, 21% oxygen, plus many other constituents present at lower levels. Some of these "other constituents" such as **water vapour, carbon dioxide, ozone, chlorofluorocarbons (CFCs), methane and nitrous oxide,** can trap energy radiated by the earth. They also moderate the sun's effect on the earth, and without them it is estimated that the average earth surface temperature would be $-18^{o}C$.

Carbon dioxide is produced by combustion of fuels such as coal, oil, natural gas, wood, peat, gasoline and propane, as well as through biological and other processes.

Although **ozone** is not directly released in large quantities by industry or vehicles, various substances that are released by combustion, and other processes, react in the atmosphere to produce ozone.

Methane, a gaseous hydrocarbon that occurs naturally in large amounts, is a product of decomposed organic matter such as in swamps, and enteric fermentation in animals, particularly ruminants. It is also released by coal, oil and gas production and processing, incomplete combustion and systems leaks.

Chlorofluorocarbons (CFCs) are synthetic compounds developed in the 20th century. They are used as propellents, refrigerants and for use with fire fighting equipment.

Nitrous oxide is produced during combustion by the oxidation of nitrogen in fuel. Nitrogen is found in molecular combination in oil and coal, but not in natural gas. (It is important to note that in this document the term "nitrous oxide" means ONLY the specific chemical compound N_2O. This meaning is the same as that accorded to the term in the field of chemistry. Later in this document there is reference to "nitric oxide" which means only the specific chemical compound NO, again in agreement with chemical usage.)

Not all of the gases contributing to the greenhouse effect result from the process of fossil fuel combustion. Some of the fastest growing and most effective of these gases are CFCs. Although CFCs are being controlled for their effect on ozone depletion, they may not be adequately considered for their potential contribution to global warming.

The remainder of this section of the paper relates to the effect of fossil fuel use as it pertains to global warming.

The world's demand for energy is increasing at a rate of 2.8% per year. Currently it is estimated that oil accounts for approximately 38% of demand; coal 33%; natural gas 23%. Non-fossil fuels - hydro electricity and nuclear power - account for just 6% of the total.

A comparison of alternative energy forms for their contribution to the greenhouse effect might be relatively simple if only carbon dioxide had to be considered. However, a dozen or more gases are involved, three of which are directly related to fuel and energy use - carbon dioxide, methane and nitrous oxide.

Carbon dioxide is the main product of all combustion processes. There is debate concerning the portion of the presently existing beneficial greenhouse effect which is due to carbon dioxide. Most of the present greenhouse effect is due to water vapour. But some scientists believe that water vapour is only found in the atmosphere due to warming created hundreds of millions of years ago by carbon dioxide. In any case, there is agreement that the contribution of methane is less than half that of carbon dioxide.

Not all fossil fuels, however, produce the same amount of carbon dioxide in the combustion process. Natural gas, because of its higher hydrogen to carbon ratio, produces the lowest level at 49.4 tonnes per terajoule. Coal combustion produces 79% more; heavy fuel oil 63% more; gasoline 37% more:

TABLE 1

CARBON DIOXIDE PRODUCED - TONNES PER TERAJOULE OF FUEL HEATING VALUE - INDUSTRIAL END-USE APPLICATIONS

Natural Gas	49.46
Light Fuel Oil	73.11
Heavy Fuel Oil	80.65
Petroleum Coke	100.00
Coal	88.90
Motor Gasoline *	67.98

* transportation end-use.

Note: 1 terajoule = 950 million BTUs

Source: Federal/Provincial Energy Ministers' Task Force On Energy and the Environment, August 1989.

As well as releasing carbon dioxide, the oil, coal and natural gas fuel cycles each produce methane. In addition, since some coals and oils have nitrogen in their fuel molecules, the combustion of these energy forms also releases nitrous oxide. Natural gas does not release nitrous oxide since its fuel molecule is devoid of nitrogen.

The contribution of a given fuel cycle to the greenhouse effect must take into account the amount of each gas released, and the activity of that gas in contributing to the greenhouse effect. For example, the activity of methane is estimated to be as much as thirty times higher than that of carbon dioxide on a unit basis. However, the amount of methane released by the natural gas fuel cycle is small. Therefore, the overall contribution of the natural gas fuel cycle to the greenhouse effect (considering carbon dioxide and methane) is smaller than that of the other fossil fuels.

As the following table shows, natural gas losses account for less than two percent of the total worldwide releases of methane. Global releases of methane are overwhelmingly caused by marshes, paddy fields, and enteric fermentation in animals:

TABLE II

Source	rate of methane release in millions of metric tons per year
Enteric fermentation in animals	90 to 220
Oceans	10
Marshes/wetlands	190 to 330
Paddy fields	35 to 280
Biomass burning	10 to 110
Anthropogenic activities	100 to 210
Natural gas losses	10
Termites	2 to 5
Earth interior	less than 30

Source: Energy and the Atmosphere, A Physical - Chemical Approach by I.M. Campbell

While the activity level of methane is higher than that of carbon dioxide, it is effective for a considerably shorter period in the atmosphere. The half life of methane is estimated at 7-10 years; the half life of carbon dioxide is many times greater.

In absolute terms, Canada, because of its relatively small population and industry base, is not a large contributor of atmospheric gases. Indeed, when viewed from a methane leakage perspective, Canada's natural gas industry appears to outperform that of the remainder of the world on average, due to higher standards of pipeline and system integrity.

In July and August 1989, the Alphatania Group, London, England, surveyed 41 natural gas operating companies around the world to determine the extent of methane leakage from their operations. It was the Group's conclusion that the world gas industry is efficient in the conservation of natural gas within its system with an overall throughput leakage factor of 0.63%:

TABLE III

Range of Specific Estimates of Methane Leakages Based on Operational Data

Production	0.20%
Transmission	0.13%
Distribution	0.30%
Total	0.63%

Source: Alphatania Group

Member companies of the Canadian Gas Association produce, transport and distribute almost all of the natural gas utilized in Canada. Available data from these sources indicate that the Canadian experience is better than the 0.63% suggested by the Alphatania survey. The low estimated leakage factor of 0.3% is perhaps due to Canadian facilities and systems which are generally newer and of a higher standard than the worldwide average.

In summary, the Association's estimate of methane emissions from natural gas industry operations are:

Transmission	0.018% to 0.082%
Distribution	0.030% 0.030%
Production	0.250% to 0.250%
	0.298% to 0.362%

Estimating the contribution of methane release from the natural gas fuel cycle to any future global warming is complicated by lack of agreement on the contribution which should be ascribed to water vapour. If water vapour is assumed to account for 50%, and if methane is assumed to account for 20% of the remaining 50%, and if natural gas industry release of methane is 2% of the world total release of methane, then the worldwide natural gas industry contribution to any future global warming is:

$$.02 \times .20 \times .50 = 0.002 \text{ or } 0.2\%$$

Nevertheless, the industry in Canada is employing new procedures to preclude waste. An example of this is the use of "blowdown" compressors to salvage gas that is contained in pipe sections upon which work is to be undertaken. The line is depressured by drawing gas off the section in question through a compressor and back into the system, instead of bleeding the pipe down to the atmosphere.

Transmission and distribution systems in Canada are frequently checked for leakage using the latest analytical instrumentation. In this way, leaks are promptly found and repaired and the amount of gas released is minimized.

Gas production wells and facilities are constantly inspected by agencies such as the Alberta Energy Resources Conservation Board, and remedial notices filed with operators. If response is not immediate the wells or facilities are shut in.

2. Ozone Depletion

Ozone present naturally in the stratosphere (25 km above the surface of the earth) absorbs the harmful portion of the sun's radiation. Four hundred million years ago, before the ozone layer developed, life on earth could only exist in bodies of water which offered protection from radiation.

An unstable compound, ozone naturally and continuously decomposes and re-forms. The ozone concentration in the stratosphere is the result of a balance between these complex opposing forces. Industrial activity introduces foreign substances, such as chlorine, into the stratosphere. These foreign substances can influence the balance between ozone production and destruction, frequently in the direction of reducing the ozone concentration.

The synthetic compounds known as chlorofluorocarbons (CFCs or Freon), were developed in the 20th century for use as refrigerants. The compounds are stable and are not destroyed in the lower atmosphere, therefore they enter the stratosphere where they are broken up, releasing chlorine. Canada has been a world leader in developing programs to restrict and ultimately end the use of CFCs.

Recommendations to eliminate CFCs have included: tight sealing and recycling of refrigerants; development of new refrigerants to replace CFCs; and phasing out CFCs in pressurized spray cans and in making foam. But since CFCs take several decades to travel from the earth's surface into the stratosphere, the damage will continue for many years, even if CFC release stops immediately.

3. Urban Smog

Photochemical smog can sometimes be seen as a yellow or brown haze on the horizon in urban areas. Smog is a mixture of ozone, peroxyacetyl nitrate (PAN), nitrogen compounds, aldehydes, and a range of other substances. In addition to undesirable environmental and health effects in urban areas, smog can be carried downwind to damage crops and forests hundreds of kilometres away.

The components of smog, mentioned above, are not directly released by industry and transportation. These sources release reactive hydrocarbons, nitric oxide, and carbon monoxide. In the presence of sunlight, the latter substances react to form the smog components.

The term "reactive hydrocarbons" is usually taken to mean all hydrocarbons other than methane. The methane molecule is relatively stable and does not participate in the reactions leading to photochemical smog. In use of any fuel in stationary or vehicular applications, there is release of hydrocarbons due to fuel leakage, and due to incomplete combustion, with appearance of hydrocarbons in the exhaust gas. Since natural gas is typically over 95% methane, natural gas leaks and natural gas combustion contribute relatively little to release of reactive hydrocarbons. Therefore, in terms of reactive hydrocarbons, natural gas is a very desirable fuel for industrial and vehicle use.

The interest in methanol as a vehicle fuel is apparently predominantly due to the low reactive hydrocarbon level in the exhaust of methanol-powered vehicles. Natural gas would appear to be preferable to methanol on the following grounds:

- In terms of reactive hydrocarbon release, natural gas vehicles are at least equal to, if not better than, methanol vehicles.

- Methanol is toxic. Significant health hazards could be created in handling of methanol, and by atmospheric concentrations of methanol resulting from fuel releases, and unburned fuel in exhaust gases.

- Methanol is manufactured from other fuels, typically natural gas or coal. There is a significant energy loss in the manufacturing process. Therefore, direct use of natural gas is more efficient.

Now shifting attention to the other smog precursors, nitric oxide and carbon monoxide, the following points can be made:

- Combustion of all fuels produces nitric oxide. For many years the natural gas industry has carried out research to find methods of reducing the amount of nitric oxide produced by natural gas combustion. During the 1980s, this work was extended to natural gas as a vehicle fuel. As an example, an inexpensive insert was developed which, when installed on burners of residential gas appliances, results in reduction of nitric oxide levels to less than half of previous values. Research and development efforts to reduce amounts of nitric oxide released by natural gas vehicles are producing encouraging results. It is expected that, in terms of nitric oxide, natural gas as a vehicle fuel will be at least equal to other fuels, if not better.

- Natural gas burns cleanly and produces less carbon monoxide than other fuels. In vehicular applications, natural gas produces significantly less carbon monoxide than methanol or gasoline.

4. Acid Rain

The term acid rain refers to precipitation which contains higher than normal levels of acidity. The increased acidity is due to release of the acid precursors sulphur dioxide and nitric oxide by industry and transportation. These precursors undergo reactions in the atmosphere to produce sulphates and nitrates. Even in the absence of rain, dry deposition of particulate matter containing sulphates and nitrates can damage soils and surface waters.

Sulphur dioxide is released by two major categories of industrial processes:

- Combustion of any fuel which contains sulphur will produce sulphur dioxide. Natural gas as used in industrial, residential, and vehicular applications contains negligible amounts of sulphur, while some coals and oils contain significant amounts of sulphur.

- Processing and refining of raw materials which contain sulphur frequently result in significant releases of sulphur dioxide.

Refining of sulphur-bearing non-ferrous ore in the Sudbury area of Ontario is a well-known example of release of sulphur dioxide to the atmosphere. Another major worldwide source of sulphur dioxide is the use of coal in electric power stations.

Raw natural gas obtained from gas fields in Alberta and from other gas fields worldwide contains sulphur compounds. As part of the refining of this raw gas, the sulphur compounds are removed. One practical reason for its removal is its potential to aid corrosion of pipelines and combustion equipment.

A large proportion of the sulphur compounds in the raw natural gas are converted to elemental sulphur which is sold to industry for use in manufacturing a variety of products. However, not all the sulphur compounds can be converted. Gas processing plants in Alberta and other producing areas release a small fraction to the atmosphere in the form of sulphur dioxide.

The amount of sulphur dioxide released in this way, per unit of heating value of the processed natural gas, is much smaller than the amount of sulphur dioxide released due to combustion of typical coals per unit of heating value of the coal. Nevertheless, the natural gas industry has worked for many years to steadily reduce the amount released by gas processing. New methods are now recovering 98% of sulphur dioxide.

For example, it was recently announced that new technology will be incorporated into an Alberta gas processing plant operated by a major producer. This new technology is expected to cut sulphur dioxide emissions to under 50% of the present level, with an investment of approximately $4 million. If expectations are met, the new technology will then be considered for other plants operated by the company.

As noted in Section 3, combustion of all fuels produces nitric oxide. Extensive research work, by the Canadian natural gas industry and by other organizations, has the objective of finding ways to reduce nitric oxide releases. One source of nitric oxide in Canada is use of natural gas as a fuel to drive compressors along the transcontinental gas pipeline. Among available engine types and related technology, the natural gas industry is using the technology which produces the lowest possible levels of nitric oxide. Developments which could lower these levels further are under review and will be applied when technically and economically feasible or when required for environmental protection.

NATURAL GAS - PART OF THE SOLUTION

Utilization efficiency improvements, which result in less fuel being used to do the same job, can do a great deal to reduce the effects of our industrial society on the environment.

Natural gas is a fuel which can be precisely controlled and which therefore lends itself to efficiency improvements. Furthermore, the natural gas industry is dedicated to greater utilization efficiency. The Canadian natural gas industry has pursued, and continues to pursue, research and development work with the objective of improving the efficiency of residential, commercial and industrial gas equipment and, more recently, motor vehicles. The accomplishments of this work are too numerous to mention here in any detail. However, some examples are:

- Introduction of high efficiency furnaces for the residential market. These furnaces have seasonal efficiencies as high as 96%, leading to dramatic reductions in fuel consumption.

- Commercial rooftop heating units have been developed which recover heat from ventilation exhaust air. These integrated units can result in cutting fuel consumption in half. They also offer rejection of heat from incoming ventilation air in summer, to reduce air-conditioning load.

- Improved equipment for heat treating and non-ferrous melting furnaces, and advanced regenerative and recuperative burners.

The substitution of natural gas for gasoline and diesel fuel in road transport. This development conveys several significant benefits:

- Reduced greenhouse contribution, taking into account the weighted effects of carbon dioxide and methane releases.

- Conversion of diesel vehicles to run on variable proportions of natural gas and diesel fuel could be an important method of reducing the diesel vehicle particulate problem.

- Generally, urban transit buses and other heavy vehicles running on natural gas rather than diesel fuel can reduce or eliminate odour and smoke (particulate) problems.

- Natural gas vehicles produce lower levels of reactive hydrocarbons and carbon monoxide, thus assisting in resolving the photochemical smog problem.

Natural gas can make various significant contributions to reducing the environmental impact of electric power generation. These include improving efficiency through cogeneration and the use of combined cycle generation and reducing the pollution from existing thermal stations through using natural gas for co-firing with other fuels and substituting off-season gas in the summer months.

To understand the role of natural gas, it may be of assistance to review some basic facts. A thermal station for electricity generation requires heat to produce steam. This heat can come from burning any fuel, or from a nuclear reaction in a nuclear power plant.

In practice, only 35 to 40% of the heat is converted to electricity, and the remainder must be rejected to the environment in the form of waste heat. This means that 60 to 65% of the pollutants released by the power plant are essentially released simply in the course of production of waste heat, which also has to be dumped into the environment.

There are various uses to which the waste heat can be put. However, the waste heat cannot be economically transported over long distances. The amount of waste heat that can be utilized in the immediate vicinity of a large thermal power station is usually only a small fraction of the total available. Furthermore, for environmental reasons, large power stations are usually sited away from population and industrial centres.

Natural gas, because it burns relatively cleanly, is particularly well suited for use in small electrical generating facilities which can be placed on the premises of the user, such as a factory, office or hospital. The waste heat from electricity generation can then be used for space heating and process purposes. The previous direct fuel use by the shopping centre or factory can be largely or completely eliminated. This technique, referred to as cogeneration, can lead to fuel consumption, and pollutant production, less than half the previous total, which included:

- The fuel previously used to produce the electricity used by the factory, office or shopping centre.

- Previous direct fuel use for space heating and process purposes.

Similarly, a method termed "combined cycle" takes exhaust heat from the gas turbine electricity generation process and uses it as combustion air in a boiler, where additional fuel is burned to produce steam to produce more electricity.

With combined cycle the amount of electricity produced from a given amount of fuel can be increased by 15 - 30% in a typical case.

In Canada and worldwide, coal-fired electric power stations are major sources of nitric oxide. Nitric oxide releases can be reduced by a compromise alternative which increases levels of other pollutants and decreases plant efficiency. However, 15 to 20% of the coal can be replaced by natural gas in a technique known as "gas re-burning". With this technique the two fuels can be burned in different locations in the boiler, under different conditions. The overall effect is greatly reduced nitric oxide release, at moderate capital cost, without increased levels of other pollutants, and without losses in efficiency.

In summary, increased use of natural gas, directly with and in substitution of other fossil fuels in residential, commercial, industrial, and transportation applications, provides reduced environmental impact in two ways:

- The process can frequently be more efficient, so that total energy use is cut.

- When energy is supplied in the form of natural gas, pollutant release per unit of energy is less.

In other words, there is a double-barreled effect: less energy use, and less environmental impact per unit of energy.

Increased use of natural gas in all market sectors leads to heightened gas exploration and development activity which will stimulate economic development and improve Canada's energy security.

The Canadian Gas Association and the Ontario Natural Gas Association applaud government initiatives to investigate environmental problems and seek solutions. The Association is prepared to play a full part in the consultative process leading to these solutions.

COFA

CANADIAN OXYGENATED FUELS ASSOCIATION
L'ASSOCIATION CANADIENNE DES CARBURANTS OXYGÉNÉS
One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9 Telephone: (416) 363-7261

November 29, 1990

Mr. Bob Mitchell
c/o The Clean Air Strategy for Alberta
2nd Floor, Highfield Place
10010 - 106 Street
Edmonton, AB
T5G 3L8

Dear Bob:

The attached presentation is provided to the Advisory Group for the Clean Air Strategy for Alberta on behalf of The Canadian Oxygenated Fuels Association (COFA).

COFA was formed by the Canadian Methanol Industry in 1984 to encourage the responsible use of methanol as a transportation fuel.

Since that time, methanol has become a leading North American alternative fuel candidate for passenger cars and heavy duty vehicles.

Methanol is a liquid fuel and can provide significant reductions in smog, particulate (black soot from diesel engines) and other toxic emissions related to gasoline and diesel engines.

Because it is a liquid, the fueling infrastructure costs related to methanol are similar to diesel and gasoline and indeed much of the infrastructure is presently compatible with methanol or can be made so with modest capital outlays.

If there are any questions on the attached presentation, we would be glad to provide further information.

We thank you for your consideration.

Yours very truly,

D.W.T. Walker
Director

Attachments

COFA Presentation
Attachment A - Toxics
GM Lumina
DDC Methanol Engine

COFA

PRESENTATION TO CLEAN AIR STRATEGY

FOR ALBERTA

ADVISORY GROUP

By
THE CANADIAN OXYGENATED
FUELS ASSOCIATION
(COFA)

December 1, 1990

COFA

THE CANADIAN OXYGENATED FUELS ASSOCIATION (COFA)

COFA is an industry partnership organized by the Canadian methanol industry in 1984 to promote the use of methanol in the transportation market. The members include:

Celanese Canada Inc.
Novacor Chemicals Ltd.
Ocelot Chemicals Inc.

BACKGROUND ON METHANOL

Methanol is a colorless liquid presently made from natural gas but which can also be made from coal. Western Canadian production is rated at 2.5 billion litres per year which is approximately 10% of world supply.

Methanol is primarily used for the production of other chemicals ending up in products like plastics, sealants, adhesives and paints. Common uses for methanol include window wash

fluid, fondue fuel and gasoline deicer.

Methanol has been used as a high performance racing fuel for many years. It is the only fuel that has been in use at the Indy 500 for over 25 years. Performance and safety are the main reasons for its use at the Indy 500.

METHANOL AS A CLEAN FUEL

Today methanol is a leading North American alternative fuel candidate to reduce tailpipe emissions and thereby improve urban air quality. Urban air pollution has become a major environmental issue in the United States where the American Lung Association have concluded that over 50,000 people die prematurely due to exhaust emission related health effects.

Methanol's air quality benefits have been clearly recognized by the U.S. Environmental Protection Agency (EPA), South Coast Air

Quality Management District (SCAQMD), California Air Resources Board (CARB) and others. Reductions in the precursor emissions to ozone, diesel particulate and other toxic emissions all result from the use of methanol as an alternative to diesel fuel and gasoline.

METHANOL IN LARGE ENGINES

In the case of diesel fuel replacement, Detroit Diesel Corporation (DDC) will have a fully warranted engine fueled by MeOH that will be certified to meet and exceed, by a considerable margin, the 1991 EPA/1991 California urban bus standards. A comparison of the methanol engine (which will be marketed by DDC in 1991 with a calalytic converter) with the 1991 standards is as follows:

DDC 6V-92TA Transit Bus Engine Exhaust Emissions Comparison

GM/GHP-HR on EPA Cycle

	HC	NOx	CO	PART
91 EPA/91 California Standards	1.3	5.0	15.5	.25/.1
1991 Diesel**	.5	4.7	1.3	.22
1991 Methanol*	.2	2.2	.8	.04

* Includes standard catalytic converter

** #1 Diesel Fuel

DDC

The DDC methanol engine is clearly the cleanest heavy duty engine in existence in the world today.

METHANOL IN PASSENGER CARS

With respect to passenger cars and light duty trucks, all the North American automobile producers and most of the European and Japanese producers have, either in development or at the pre-production stage, flexible fueled vehicles that will run on methanol.

These cars will provide significant reductions in ozone pollution since compared to gasoline, methanol produces not only lower levels of emissions but the ozone forming potential of these emissions is significantly less. EPA has reported that methanol flexible fueled vehicles will produce 30–50% less ozone than gasoline vehicles. When fully optimized, dedicated methanol vehicles are expected to produce 80% less ozone than gasoline powered vehicles.

In addition, replacing gasoline with methanol is projected by the EPA to substantially reduce emissions of benzene, 1.3 butadene and polycyclic organic material. This will result in a significant reduction in cancer problems related to gasoline exposure. (Note Attachment A)

Some concern has been expressed with formaldehyde emissions from methanol fueled cars. While tailpipe emissions of formaldehyde can be higher with some of the prototype flex

fuel cars, it is most important to recognize that EPA have reported that formaldehyde found in the air comes mostly from the action of sunlight on hydrocarbon exhaust emissions. Since methanol exhaust is less photochemically reactive, ambient formaldehyde levels overall would be reduced compared to gasoline.

Recent emission tests done on pre-production methanol vehicles also suggest that formaldehyde tailpipe emissions will not be a factor by the time these vehicles are commercial.

METHANOL AND GLOBAL WARMING

Methanol substitution for gasoline and diesel fuel has been shown in recent studies to lower CO_2 emissions, thereby reducing global warming from the greenhouse effect.

METHANOL AND ENERGY SECURITY

In addition to the positive impact methanol will have on air quality, it also provides benefits relative to energy security in that it helps to reduce our almost total dependency on oil for our transportation needs.

RECOMMENDATIONS

In light of the above, COFA would like to make the following recommendations:

1) That there be a means of insuring that all new and replacement fueling station tanks be methanol compatible in Alberta.

2) That the Alberta government provide incentives relative to the installation of new methanol tanks, and conversion of existing fuel systems to MeOH compatibility.

3) That the Alberta government specify the purchase of alternate fueled vehicles as part of a provincial clean air policy.

4) That Alberta leave in effect the provincial road tax exemption for methanol and other alternate fuels until they reach commercial status.

COFA

ATTACHMENT A

Table 5
Known and Suspected Toxics
Emitted from Vehicles Powered
by Commercially Available Fuels[40]

SUBSTANCE	GASOLINE	DIESEL	METHANOL
Benzene	o	o	
Xylenes	o	o	
1,3 Butadiene	o	o	
Chromium	o	o	
Manganese	o	o	
Nickel	o	o	
Mercury	o	o	
Arsenic		o	
Lead	o	o	
Cadmium	o	o	
Formaldehyde	o	o	o
Acetaldehyde	o	o	o
Acrolein	o	o	o
Phenol	o	o	o*
Cresols	o	o	o*
PAHs	o	o	o*
Dioxins	o	o	
Nitrosomorpholine		o	
Nitrosamines	o	o	
Nitrobenzene	o	o	
Chloroform	o	o	
Ethylene Dibromide	o		
Ethylene Dichloride	o		
Ethyl Bromide	o		

* Denotes toxics from combustion of lubricating oil.

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[40]James Boyd, Statement to Advisory Board on Air Quality and Fuels.

NOTE: Attached Publications

1. What Can Methanol Vehicles Do for the Environment
2. Lumina Methanol Variable Fueled Vehicle Unique Components
3. Detroit Diesel Methanol Fueled Engine Program

THE FACTS REGARDING METHANOL

Availability/Usage:

- Canada's methanol industry accounts for 10% of the world supply of methanol and has the raw material potential to guarantee a long term supply.
- Methanol is quickly becoming the preferred alternative fuel for automobile manufacturers in North America, Europe and Japan. A new generation of fuel-flexible cars is currently being developed which can run on any blend of gasoline and methanol.
- Studies have shown that fuel-grade methanol will be competitive with conventional fuels.
- Methanol-fueled vehicle prices, mileage ranges, operating costs, performance and safety all favour consumer acceptance of methanol.

WHAT'S NEXT FOR METHANOL

With increasing attention being paid to cleaner fuels, the importance of methanol will increase as a viable and practical alternative to conventional fuels.

The major hurdle for methanol is to establish the initial market volume so that it will begin to take advantage of the extensive pipelines and other efficient fuel distribution systems currently in place. Methanol already offers important energy diversity and, as crude oil prices rise, methanol will become even more competitive.

WHAT IS METHANOL?

Methanol is the fuel for tomorrow — today. It is a liquid, usually made from natural gas, which is in abundant supply in Canada. It can also be made from a wide variety of raw materials, including coal, lignite, wood and even garbage.

You're probably not aware that methanol is widely used in our day to day activities. It's a major component in windshield washer fluid and gas-line deicer. In the kitchen, we use methanol for fondue cooking, and hobbyists use methanol to fuel model airplanes. It is a raw material for paints, plywood and high-quality plastics, as well as for the most important clean-air fuel additive today — MTBE.

For further information, please contact:

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COFA

CANADIAN OXYGENATED FUELS ASSOCIATION

WHAT CAN METHANOL VEHICLES DO FOR THE ENVIRONMENT?

Printed on recycled paper

Truth of the matter is that in the United States most drivers have already used methanol to help reduce auto emissions.

As lead was taken out of gasoline in the U.S., it was replaced by a methanol derivative — MTBE. This new fuel additive not only made high-performance lead-free fuels possible, but increased the oxygen and octane content of the fuels as well. The benefits were clear then; they're even more important now.

Methanol as today's alternative to gasoline and diesel — in addition to being an important additive — provides an even more dramatic benefit to the environment. Methanol is not science-fiction; it is here today to help us meet our new environmental objectives of cleaner air. Let's take a closer look at the numerous benefits of methanol.

METHANOL AS A FUEL

Methanol is already recognized as one of the safest high-performance fuels available — it's been the only fuel used at the Indy 500 for 25 years.

In passenger cars, buses and trucks, methanol burns very cleanly, significantly reducing air pollutants. As an alternative to gasoline, methanol will have a major impact in cleaning our air by reducing ground level ozone.

Using methanol to replace diesel also significantly reduces sooty particulate emissions and nitrogen oxides which pollute our urban areas.

THE FACTS REGARDING METHANOL

Safety:

- The U.S. Environmental Protection Agency has concluded that methanol, unlike components of gasoline, is not a carcinogen and is not considered a toxic air pollutant.
- Methanol is far less flammable than gasoline, and much easier to handle than gaseous fuels.
- The EPA has concluded that fire risks of methanol are lower than for gasoline. This is particularly true in today's 85/15 methanol/gasoline blend, which provides visibility to the flame and allows cars to start more easily in colder climates.
- The EPA has also concluded that risks associated with spills while transporting methanol are considerably smaller than from transporting crude oil or gasoline.
- The California Advisory Board on Air Quality and Fuels, after a year of comprehensive examination, concluded that methanol use, with standard precautions, does not involve any unusual or unacceptable safety issues — particularly compared to gasoline.
- Handling procedures for methanol are similar to those for gasoline and diesel. Like these fuels, methanol should not be taken internally, and skin contact with all these fuels should be avoided.

THE FACTS REGARDING METHANOL

Emission Reduction:

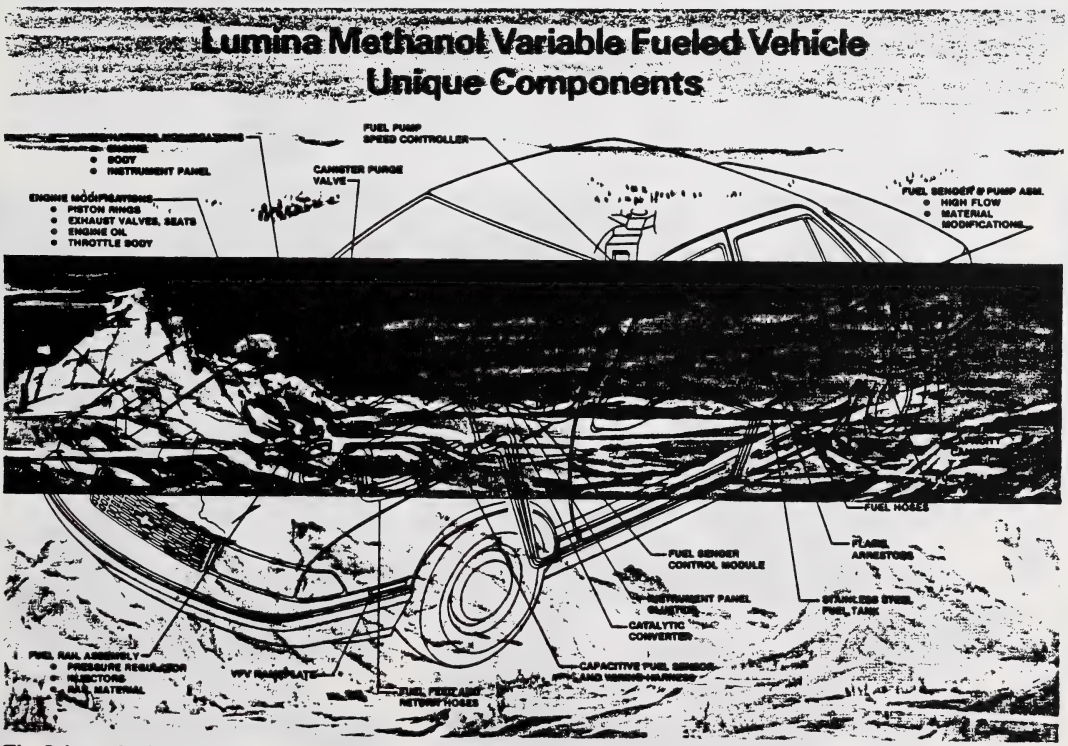
- The State of California, long concerned about energy security and air quality, has recommended that methanol, as well as other clean fuels, be used to improve air quality in Los Angeles. Methanol fuelling stations, passenger cars, buses and trucks are now in use in California, and are expected to grow in significance in that state's clean air strategy.
- Bus and truck engines have already been redesigned and built to run on methanol. North America's largest diesel bus engine manufacturer — Detroit Diesel Corp. — is producing methanol transit bus engines, and 65 methanol-fueled buses are currently in service across the United States and Canada.
- The U.S. Environmental Protection Agency has concluded that methanol use in vehicles will cause no increase in formaldehyde levels in the atmosphere. The EPA has determined that, although methanol vehicles have higher formaldehyde tailpipe emissions, emissions from current conventional-fuel vehicles are coverted photochemically to formaldehyde to a greater extent.
- New technology to reduce formaldehyde tailpipe emissions is already being developed, so that, in the future, methanol vehicles should actually reduce current levels of formaldehyde in the atmosphere.
- There is growing recognition that as a transportation fuel, methanol and its derivatives have the capacity to make enormous contributions to clean air by reducing ground-level ozone, carbon monoxide, NOx and particulate emissions.

The GM methanol system is particularly desirable because it converts automatically from 100% unleaded gasoline up to 85% methanol fuel. Drivers will have the choice between operating on methanol, gasoline, or a mixture of both. The car will automatically sense the fuel mix and make the appropriate adjustments.

GMCL is working with other alternative fuels as well. We are providing technical assistance to Canadian companies which are retrofitting and modifying current and late model vehicles for natural gas and propane use. Vans from our Scarborough Plant are being retrofitted by outside companies with powerful lead-acid batteries which supply the vans with electric power.

General Motors of Canada also participates on a Steering Committee with the Ontario Ministry of Energy which is reviewing the feasibility of developing electric vehicles.

General Motors of Canada is experimenting with a host of available sources of energy. Our objectives are to reduce vehicle emissions, enhance fuel economy and ensure technology is available to adapt to situations of fuel shortages.



The Oshawa-built Methanol powered Lumina and its unique fuel components.

Clean Air

Reducing air pollution is an important objective of General Motors of Canada.

Factory stacks are sampled to ensure the efficiency of our pollution control equipment. All new stacks are certified by the Ministry of the Environment to ensure ambient air quality within our communities. Millions of dollars are spent to install control equipment as we build new plants and upgrade existing facilities to continually improve air quality.

The St. Catharines Foundry recently has completed extensive upgrades of its cupola emission control systems. A state-of-the-art microprocessor now controls the combustion of exhaust gases. Proven "top take-off" arrangements route gases from cupola furnaces to high energy scrubbers.

Scrubbers in many of our plants are used to reduce stack emissions by washing contaminants from the air stream. The water used in this process is contained and treated after the operation is complete. The result is cleaner air and improved reliability. "Baghouses" are also used in the exhaust stacks of several of our plants to remove contaminants from the air prior to discharge into the atmosphere.

GMCL has eradicated lead body filler joints from its manufacturing processes and now uses silicon-bronze instead of conventional solder welds to further reduce air emissions.

At GMCL, we are working hard to provide cleaner air.

Reducing Vehicle Emissions

General Motors' scientists and engineers have made numerous important advances in controlling vehicle emissions.

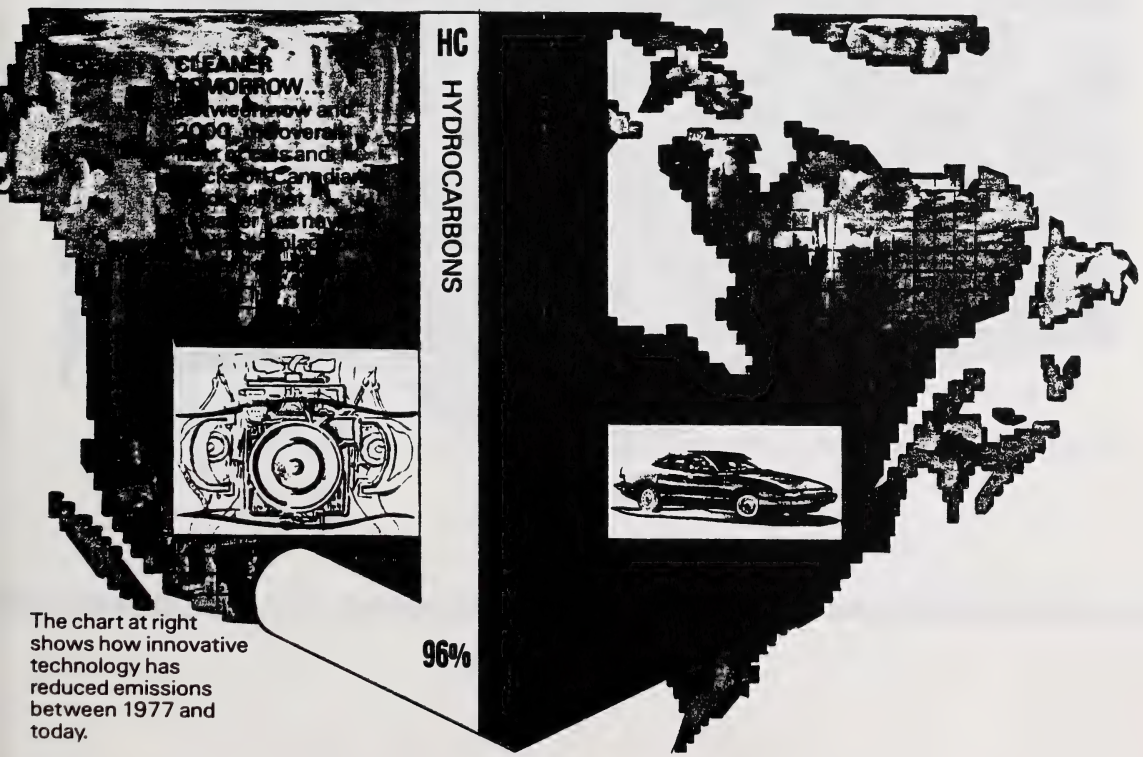
Today's cars contain emission control systems which have reduced emissions 90% on average from precontrol levels.

Testing done on GM vehicles shows emissions of hydrocarbons have been reduced 96 percent from precontrol levels. An overall reduction in carbon monoxides of 96 percent and a reduction of nitrogen oxides by 76 percent from precontrol levels have also been achieved. As newer vehicles replace older ones, overall emissions will decrease substantially.

These reductions in emissions are achieved through a number of technologies including catalytic converters, Positive Crankcase Ventilation, closed loop emission controls, fuel injection, electronic ignition, exhaust gas recirculation, and air injection.

General Motors supports the use of properly blended oxygenated fuels, such as methanol and ethanol. Motor gasolines that contain low levels of oxygenates not only improve octane levels, but may also reduce carbon monoxide emissions from vehicles.

We are continuing to pursue new technologies and new products to improve auto emissions and air quality. You can help too. Always use unleaded gasolines or recommended oxygenated fuels as described in your owner's manual. Have your vehicle serviced regularly to ensure that it is in top running order. Maintain your tires at the recommended pressure. If each one of us takes these small steps, the overall result will be a cleaner Canada.



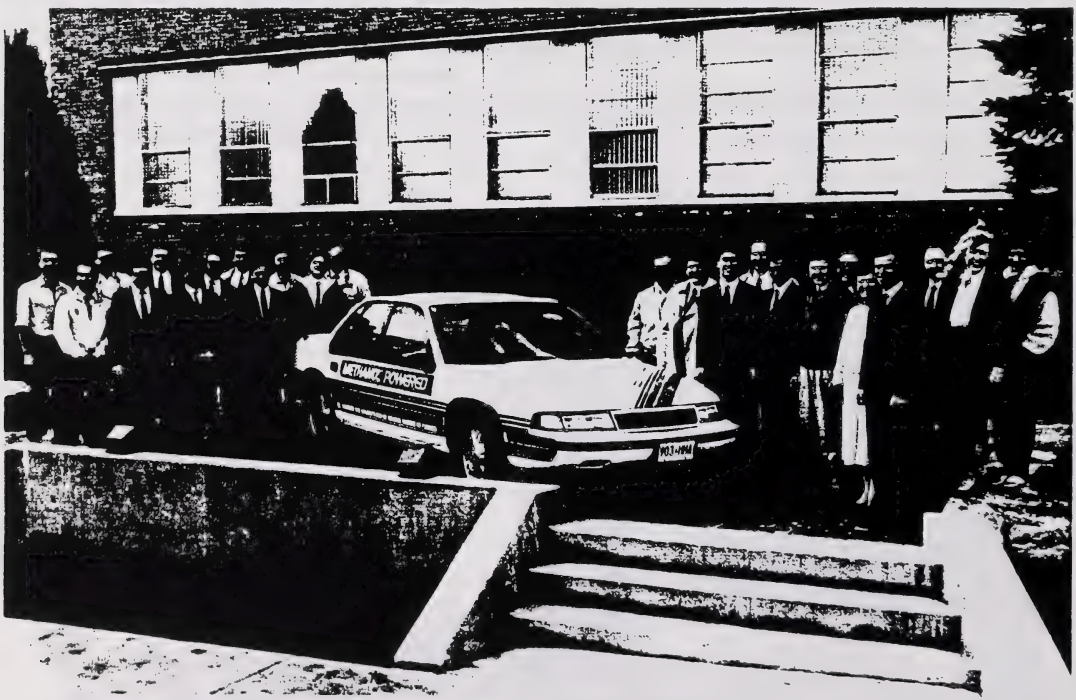
The chart at right shows how innovative technology has reduced emissions between 1977 and today.

Alternative Fuels

General Motors of Canada is addressing the challenge of alternative fuels with a number of important initiatives.

GMCL is leading the way with our methanol program. Methanol is made from natural gas. Canada is one of the largest methanol suppliers in the world, with eighty-five percent of all methanol production exported to world markets. Methanol may prove to be an effective tool in achieving cleaner air in North America's large cities. However, a number of important environmental, mechanical and distribution questions remain to be solved and General Motors is working hard to find the answers to these issues.

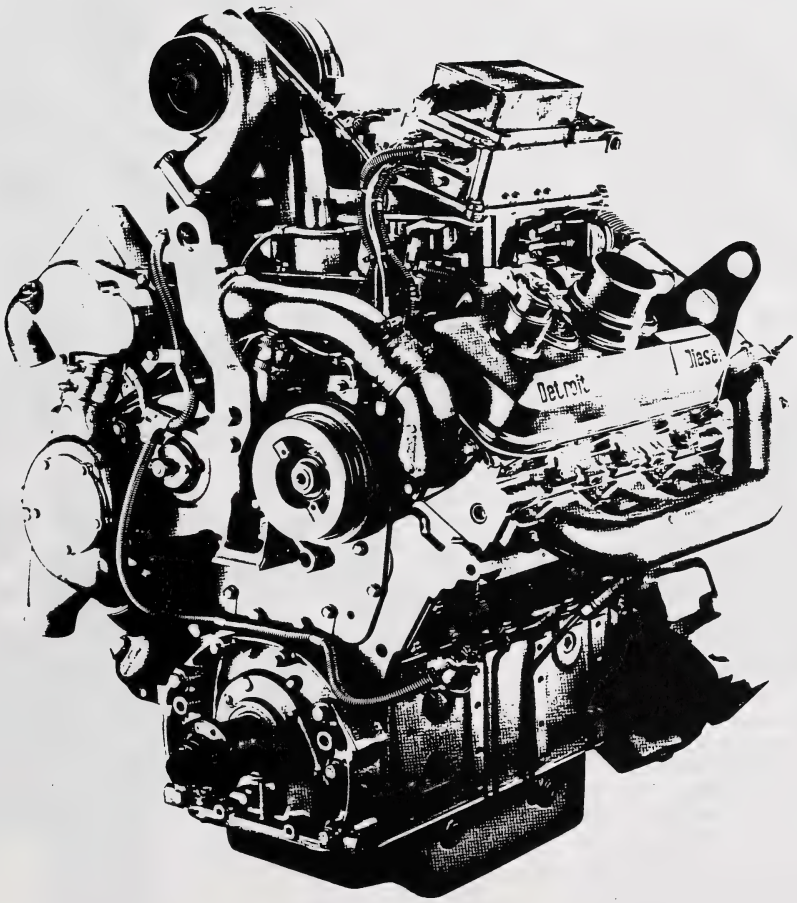
Since September 1988, GM has refitted 20 Corsicas to operate on a range of methanol/gasoline mixtures. Fifteen prototype Luminas built in Oshawa are being tested at GM's Kapuskasing, Ontario Cold Weather Test Facility, the Arizona Desert Proving Grounds, and the High Altitude Test Center in Denver, Colorado. These early prototypes are test vehicles for the 2,200 vehicles which General Motors of Canada will be producing for use in California.



General Motors of Canada's Alternative Fuels Team, with the Oshawa-built methanol powered Lumina.

DETROIT DIESEL

Methanol Fueled Engine Program



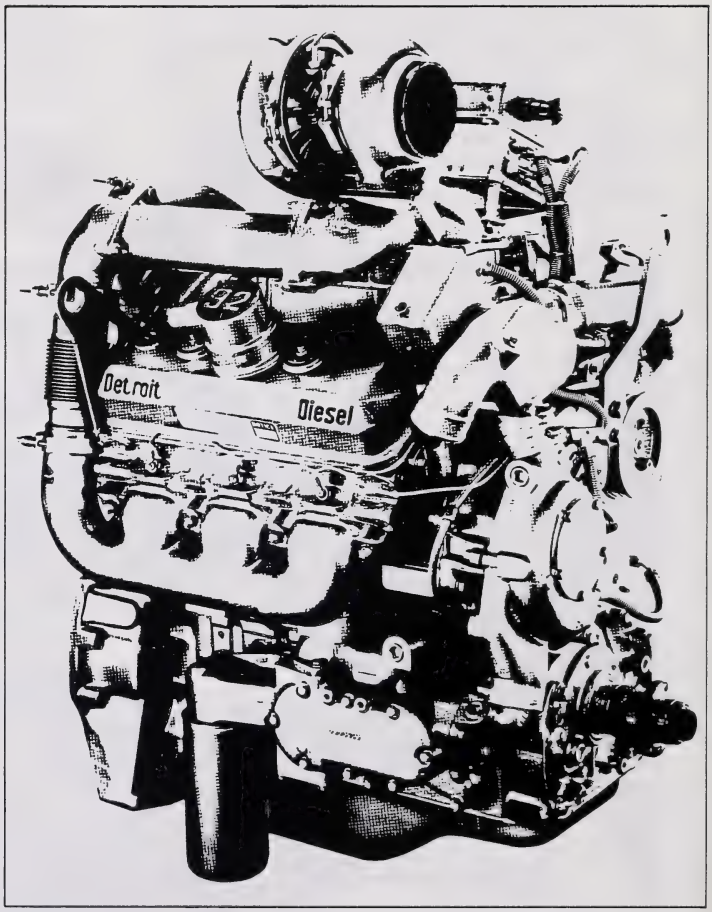
Our Commitment to the Transportation Industry

Detroit Diesel Corporation is committed to providing the very finest engines to the bus and truck industry. We are dedicated to upgrading and adapting our engines to meet customer needs while meeting or exceeding clean air standards and lessening our dependence on foreign oil. Our research with methanol fuel engines is being undertaken in this spirit.

Background

Alternate fuels for internal combustion engines are receiving increased emphasis due to concerns about air pollution and petroleum supplies. Alternatives most commonly proposed are alcohols and natural gas. For an alternative fuel to be practical, there must be producers and suppliers capable of providing the fuel when and where it is needed. In addition to being available and having a reasonable cost, a fuel must perform satisfactorily.

Methanol is a promising alternative for vehicular engines because it is a clean burning, relatively safe liquid with a reasonable cost. Today's methanol fueled engines may be the only viable technology available to meet the extremely stringent 1991 urban bus emission standards. The two pollutants which the EPA is most concerned about from diesel engines and two pollutants for which standards are lowered in 1991 are particulate matter (BSP) and nitrogen oxides (NOX).

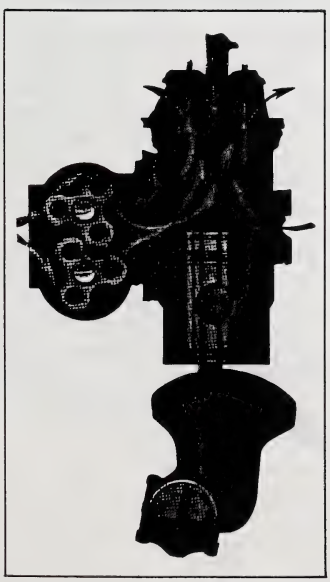


6V-92TA Methanol Fueled Engine

Advantages of Converting Detroit Diesel Two-Cycle Engines to Methanol

A four-stroke engine uses the piston to push combustion products out of the cylinder and to draw in fresh air (or fuel/air mixture). A two-stroke engine removes combustion products near the bottom of the piston stroke by use of a blower which blows in fresh air to scavenge (push out) the exhaust gas. Because there is considerable mixing during this scavenging process, the cylinder contents typically contain substantial hot exhaust gas when scavenging ends. This hot residual gas makes compression-ignition of low ignition-quality fuels such as methanol relatively easy, especially if the quantity of residual is increased when necessary. Therefore, two-stroke engines have an advantage in compression-igniting fuels of poor ignition quality. In addition, the technology of burning methanol in a Detroit Diesel engine was aided by the use of advanced technology systems Detroit Diesel has developed for commercial applications. These technologies include the Detroit Diesel Electronic Control (DDEC) system, the full bypass air system and the glow plug starting system.

2-Cycle Piston

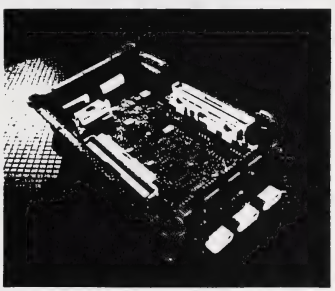


Detroit Diesel Electronic Controls (DDEC)

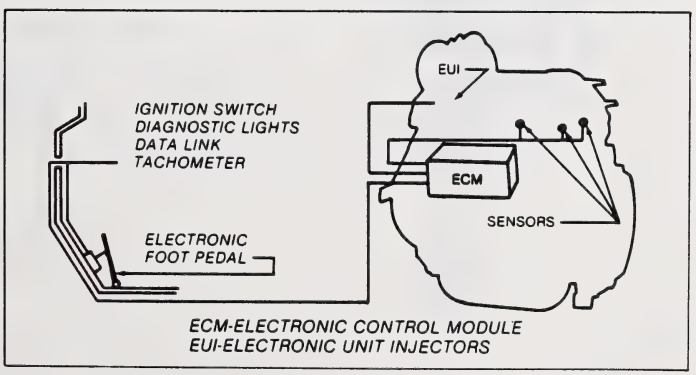
Undoubtedly, the greatest single advancement in diesel engine technology during the 1980's has been engine electronics. Detroit Diesel pioneered engine electronics in 1985 with the introduction of DDEC. The purpose of electronics is to manage engine operation under continually varying conditions to optimize performance and economy while meeting emission standards.

Its major components are the Electronic Control Module (ECM) and the Electronic Unit Injectors (EUI). The ECM is the brain of the system, receiving electronic inputs from the driver as well as engine mounted sensors that provide information electronically, such as oil pressure and temperature, speed and intake manifold pressure. This information is used to control both the quantity of fuel injected and injection timing.

The electronics contain a PROM (Programmable Read Only Memory) which is mounted in the ECM



Electronic Control Module (ECM)



ECM-ELECTRONIC CONTROL MODULE
EUI-ELECTRONIC UNIT INJECTORS

and encoded with your engine's performance characteristics. Included in the PROM is information to control the horsepower rating, torque curve, maximum engine speed and optional protection devices. The ECM processes this information and sends electronic signals to the Electronic Unit Injectors where the precise amount of fuel is injected.

Electronic Unit Injector

The electronic unit injector works on the same basic principle as the mechanical unit injector with the simple addition of an electronically controlled solenoid valve that meters and times fuel input.

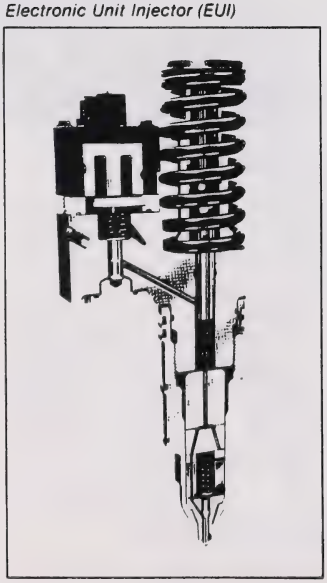
Bypass Air System

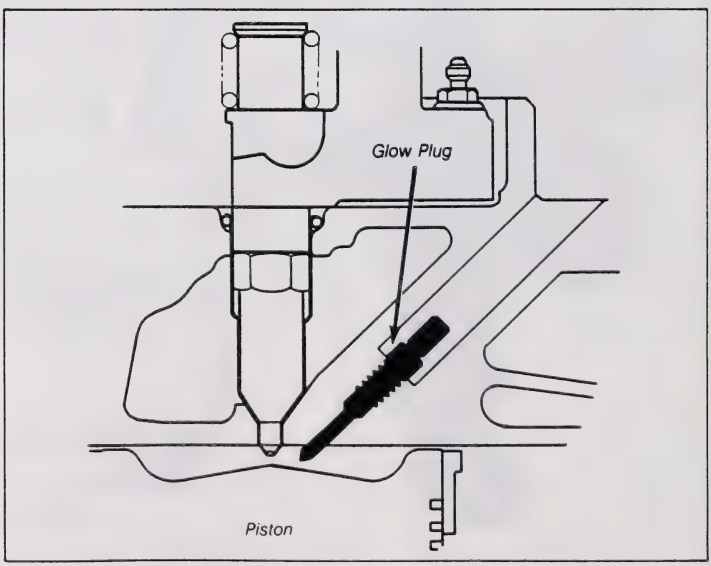
The bypass air system is a key component for correct metering and mixing of fresh air and retained exhaust gases in order to achieve the necessary methanol compression ignition temperature. The bypass air system is controlled by an electric/pneumatic system which senses engine accessory and vehicle operating conditions.

Glow Plug System

The glow plug system is similar to systems developed by General Motors for use in passenger cars but has been modified by DDC for heavy duty engines and for use with DDEC. Electrically heated glow plugs are presently used to start the engine and to assist low speed and light load operation. DDC is continuing to study the ignition process with the objective of minimizing the need for glow plugs. Research and development is also continuing in other areas including fuel pump, injectors, valve seats and lubricating oil.

Electronic Unit Injector (EUI)





On the Road Testing

In 1983, the first and longest running Detroit Diesel methanol-powered bus, Methanol 1, began service at Golden Gate Transit in California. Today it has accumulated over 60,000 miles of service. Detroit Diesel methanol-powered transit buses have also been operating in Jacksonville, Fl., Medicine Hat, Alberta, Canada and Winnipeg, Manitoba, Canada.

In 1987 Detroit Diesel Corporation provided nine (9) experimental methanol-fueled 6V-92TA engines to two transit bus pilot programs on opposite coasts of the United States. These buses all went into service in April, 1988.

New York put six (6) methanol-fueled, Detroit Diesel powered buses in regular passenger service and in Riverside, California Riverside Transit Agency introduced three (3) Detroit Diesel methanol-powered buses named Clean Air 1, 2 and 3.

Both the New York City and Riverside methanol-fueled programs are beginning three-year, real world testing which will provide further data on performance, fuel economy, maintenance and repair requirements, as well as public acceptance of the buses.

By fall of 1988, an additional 37 Detroit Diesel 6V-92TA methanol-powered buses will be placed in service with transit agencies in three U.S. cities.

Some of the experimental methanol-powered buses placed in service will also be used for exhaust catalyst development. The catalyst is similar to those used on passenger cars and acts to effectively remove unburned methanol, formaldehyde, carbon monoxide and particulates.

DETROIT DIESEL
CORPORATION
13400 Outer Drive, West / Detroit, Michigan 48239-4001
Telephone: 313-592-5000
Telex: 4320091 / TWX: 810-221-1649

6SA319 8807 As technical advancements continue, specifications will change. Litho in USA

MR. ORMAN

Dear Sir,

I am a grade 9 student at Lorne Akins J.H., in St. Albert. I am writing to you to express my concern over the developement and operation of a sour gas ~~pass~~ processing plant within 2 miles of my residence. Since this plan will emit **hazardous** gasses contributing to **acid rain**, and in addition, since sour gas contains **hydrogen sulphide**, a **lethal** substence. In the event of a plant failure, fire or explosion this could have a **CATASTROPHIC** effect on my community. I am writing this letter to ask you what **you** are doing to **protect** the **Environment** and my community.

Very truly your,

Leah C. ~~Bertsch~~

Leah C. Bertsch

53 Butterfielder
St. Albert, Alberta
Canada T8N 2W6

30 Nov 1990

Re: Clean air strategy, Alta.:

The purpose of monitoring and regulating air quality must stem from concern for health, and environmental damage. The current approach does not jibe with this because Alberta Environment concerns itself only with standards and measurements of ~~particu~~ specific pollutants, not with overall air quality. For example, many pollutants with known and unknown health effects are simply ignored. This system is designed around pollutants and their producers, not around the needs of the people and the environment.

Sincerely,

Mitch Bronaugh
10984 122 St
Edmonton, Alta.
T5M 0B1

MITCH DEONANDIA

IMPLICATIONS OF NORTHERN ALBERTA FORESTRY PROJECTS FOR THE ENERGY SECTOR: AIR POLLUTION CONSIDERATIONS

Although pulp mills do emit some of the same air pollutants as those associated with the oil and gas industry, other effects of their activities promise more serious difficulties for energy companies and the public due to air pollution problems. One area of concern is the increased air pollution concentrations which will result from removal of portions of the forest. The other is the terms of Daishowa's (and presumably Alpac's) FMA which states that the primary purpose of the area is to grow pulp wood for the FMA holder, and decrees that other industrial users must compensate them for any damage to "their" trees.

I include with this note (1) a paper by Mayer and Ulrich describing very different sulfur deposition rates in forests as opposed to cleared land; (2) a paper by my colleague Tammy Marawa which documents detrimental effects on Alberta trees from sulfur deposition (including reduced growth rates), quoting ADOF sources; (3) an excerpt from the Daishowa FMA outlining the FMA holder's right to compensation for damage to trees, including reduced growth rates; (4) a copy of an Alberta Forestry map showing the extent of existing and proposed FMA's; and (5) an excerpt from a paper by Outrim and Evans with maps indicating the extent of heavy oil deposits in Alberta.

As the above mentioned documents show, (1) most of Alberta's famed heavy oil deposits--well over one trillion barrels of bitumen--directly underlie the Daishowa and proposed Alpac FMA's; (2) the FMA holder will be entitled to compensation by an energy company for any damage to trees caused by the energy company's activities, including tar sands plants; damage such as described in the FMA agreement has already been documented near sour gas plants in Alberta; (4) effects of air pollutants, including effects on remaining trees, will be incresed by reduction of forest cover, since trees remove pollutants from the air. As the enclosed article from the Calgary Herald reports, oil companies are already complaining that FMA holders are charging them much more for damages than the Crown does outside FMA's, which is bad for any oil company which is not a subsidiary of the FMA holder. It is also bad for the tax payers, because the money is paid to a foreign owned corporation, not into the public purse.

Atmospheric Environment Vol. 12, pp. 375–377. Pergamon Press 1978. Printed in Great Britain

INPUT OF ATMOSPHERIC SULFUR BY DRY AND WET DEPOSITION TO TWO CENTRAL EUROPEAN FOREST ECOSYSTEMS

R. MAYER and B. ULRICH

Institut für Bodenkunde und Waldernährung der Universität Göttingen.
Büsgenweg 2, D-3400 Göttingen, F. R. Germany

(*First received* 13 *June* 1977)

Abstract—The total input of atmospheric sulfur to a beech and a spruce forest in the Federal Republic of Germany has been measured over a period of 6 years. The contribution of dry deposition to the total input was determined indirectly by comparing seasonal changes in the sulfur flux coupled with precipitation beneath the canopy of the deciduous beech forest. As a result of these investigations seasonal and annual sulfur fluxes are reported corresponding to removal rates of atmospheric sulfur. The experimental data show clearly that the removal rates depend upon the quality of the atmosphere land interface, in forested areas from the tree species forming the canopy. The 6-years average of total deposition on bare soil is 23 kg S ha^{-1} y^{-1}, on a beech forest 47–51 kg S ha^{-1} y^{-1}, on a spruce forest 80–86 kg S ha^{-1} y^{-1}. Based upon the experimental results the role of the forest vegetation in the removal of sulfur from the atmosphere in the area of the Federal Republic of Germany is considered. The figures indicate, that at least 50% of the total sulfur deposition takes place on forested areas which cover only 28% of the total land surface.

INTRODUCTION

Deposition of most ion species, including SO_4^{2-}, measured in the precipitation below the canopy of a forest stand exceeds that measured above the canopy. The increase in the element flux during canopy passage of precipitation is due to dissolution of substances when plant surfaces (leaves, needles, bark) are wetted, or to dry fallout reaching the forest floor subsequently being dissolved in the rain water within the collector. The origin of these substances has been attributed to biological and meteorological sources:

(1) Metabolites from the internal turnover of the trees as, e.g. solutes carried by the transpiration stream to the leaf surfaces, substances resulting from assimilation and respiration processes, or litter particles being decomposed.

(2) Dry deposition of airborne particles, aerosols and gases. This flux depends upon the deposition velocity of substances present in the atmosphere which is controlled by the surface resistance of the canopy, i.e. its physical structure and surface conditions. It has therefore been called 'filtering' by ecologists, since the vegetation cover acts as a filter for atmospheric substances, and these may contribute significantly to the element balance of an ecosystem.

DESCRIPTION OF SITES AND METHODS

The data presented here are resulting from investigations on the element balance of forest ecosystems in central Europe. Research sites are a beech forest (*Fagus silvatica*, age: 125 years) and a spruce forest (*Picea abies*, age: 85 years) located at an altitude of about 500 m a.s.l. in a densely forested mountainous area without large industries or cities about 40 km northwest of Göttingen. Mean annual precipitation is about 1000 mm. Average SO_2-concentrations in the atmosphere range from 5 to 10 μg SO_2 m^{-3} during summer and from 10–20 μg SO_2 m^{-3} during winter. A detailed site description is given by Ellenberg (1971), the methods for measuring the amount and chemical composition of precipitation were: (a) 15 raingauges below the canopy of both forest stands and on a non-forested area close to the forest sites, (b) 3 rain-gutters of 1.5 m^2 surface area below the canopy of both forest stands, (c) stemflow collectors fixed around the beech stems on a total area of 800 m^2.

No measurements were taken to separate wet and dry deposition, but raingauges under the canopy collecting precipitation for chemical analysis were covered by a screen to keep out coarse litter. During winter larger collectors were used to get snow samples.

Samples were taken from the collectors after each precipitation period and stored in a deep-freezer. Chemical analysis was done on monthly samples. Sulfur was determined after separation of phosphate, fluoride and Fe^{3+} as SO_4^{2-} by colorimetry on a Technicon Auto Analyzer using SPADNS as complexing agent. The investigations have been made without interruption since November 1966.

RESULTS

In Table 1 the deposition (wetfall plus dryfall) of S measured on the open plot and under canopy is

Table 1. Deposition of sulfur (dryfall plus wetfall) and precipitation

		1969		1970		1971		1972		1973		1974	
		W	S	W	S	W	S	W	S	W	S	W	S
BS on a non-forested area (bare soil)†	Kg S ha^{-1}	12.3	12.5	14.0	12.9	9.2	10.5	9.5	14.1	13.6	8.0	10.4	12.5
CP below beech canopy*	kg S ha^{-1}	39.2	33.5	27.6	25.0	18.1	16.9	24.7	22.5	21.9	21.0	21.8	32.2
CP below spruce canopy	kg S ha^{-1}	66.5	41.2	46.7	41.3	34.0	29.6	42.4	34.4	55.6	29.5	44.1	55.1
Precipitation	l. m^{-2}	436	530	730	681	399	370	346	550	435	450	386	602

* Stemflow included. W = Winter (November–April). S = Summer (May–October).
† Soil adsorption neglected.

given for different seasons and years. Sulfur was found to be nearly exclusively in the form of SO_4^{2-}.

The sulfur flux below the canopy considerably exceeds the input from the atmosphere to the non-forested area (bare soil). In the case of the beech forest the difference between both of these fluxes may be taken, during the winter months, as an additional input from the atmosphere. Leaching of metabolites should be negligible when the canopy is defoliated and the physiological activity of the beech as well as litter fall is largely reduced. The only source remaining for the observed flux increase is dry deposition from the atmosphere.

Mayer and Ulrich (1974) have estimated dry deposition ('filtering') during the vegetation period (May–October) by using the same ratio between total deposition on bare soil and additional dry deposition on the canopy for the winter as well as for the summer months. The same flux ratio was later applied to an evergreen spruce forest within the same area (Ulrich *et al.*, 1977). With this approach, assuming the same 'filter efficiency' of the canopy whether leaves are present or not, the additional dry deposition to the beech forest during the summer is most likely underestimated.

In the 6-year period under investigation the estimated input of sulfur by dry deposition accounted, during the vegetation period, for more than 75% of the sulfur flux increase during canopy passage of precipitation (Mayer and Ulrich, 1977). It follows, that, within the period May through October, leaching of metabolites from the canopy contributes less than 25% of the flux increase.

Systematic errors may lead to an overestimate of the input from the atmosphere when, during the winter months, decomposition of plant parts or litter particles occurs. In the case of sulfur this source of error is most probably negligible due to the relatively small S content of the biomass. The total annual litter fall of the beech forest (3.2 kg S ha^{-1} y^{-1}; Mayer and Ulrich, 1974) yields only about 6% of the S-flux coupled with precipitation below the canopy.

For the same reason it may be concluded, that uptake of S (or SO_2) through the stomata does not play an important role in the sulfur balance of the forest stands provided there is no transfer of sulfur from the leaves to the roots and to the soil against the transpiration stream—which again is very unlikely. The annual increment in the biomass of the beech forest is less than 1 kg S ha^{-1} y^{-1} (Mayer and Ulrich, 1974). Based upon this reasoning, the mean annual sulfur input from the atmosphere by wet and dry deposition, IN_{atm}, to the beech and the spruce stand within the period November 1968 through October 1974 was calculated in the following way:

(1) Maximum values:

$$IN_{atm} = CP_{sw} = CP_{ss} - CP_{su}$$

where CP_{sw} is the annual sulfur flux below the canopy. Contribution of internal turnover as well as net uptake of S by the leaves and translocation to the tree are assumed to be negligible.

(2) Minimum values:

$$IN_{atm} = IN_{min} - IN_{ss}$$

with

$$IN_{min} = CP_{ss}$$

and

$$IN_{ss} = BS_{ss} - 0.75(CP_{ss} - BS_{ss})$$

where the subscripts *s* and *w* indicate summer (May–October) and winter (November–April) periods. *CP* is the sulfur flux below canopy, *BS* is the sulfur flux on bare soil. The difference (*CP* − *BS*) gives the flux increase during canopy passage. 75%, of which is taken as (minimum) dry deposition.

Table 2. Mean deposition of sulfur (wetfall plus dryfall) IN_{atm} within the period November 1968 through October 1974

		kg S ha^{-1} y^{-1}	mg S m^{-2} d^{-1}
On a non-forested area (bare soil)		23.3	0.4
On a beech forest	maximum	51.8	13.9
	minimum	47.4	13.0
On a spruce forest	maximum	99.4	23.7
	minimum	78.8	21.6

Precipitation (Nov. '68–Oct. '74): 641 l. m^{-2}; 30-year average: 1030 l. m^{-2}

Results are given in Table 2. The data may be used for a rough estimate of the annual sulfur deposition on the area of the Federal Republic of Germany:

Total surface F.R.G.	24.7×10^6 ha
including	
non-forested area	17.7×10^6 ha
forested area	
—coniferous forests	4.2×10^6 ha
—deciduous forests	2.8×10^6 ha

If we take the mean deposition rates from Table 2 the annual sulfur deposition is calculated:

Deposition on non-forested areas	410×10^6 kg S
on forested areas	490×10^6 kg S
including	
—on coniferous forests	350×10^6 kg S
—on deciduous forests	140×10^6 kg S

It must be stated, that this estimate can only be approximative for a larger deposition is found close to the emittents (industries, cities), and the distinction of the total land surface into three surface types is an oversimplification. Nevertheless it may give a good idea of the relative importance of the forest in the removal of sulfur from the atmosphere. The total anthropogenic emission of sulfur within the Federal Republic of Germany in 1970 is estimated to 1800×10^6 kg (VDI-Berichte, 1972). Estimates of the annual emission of gaseous sulfur into the atmosphere by natural processes (mainly biological decay) are very uncertain. Taking the figures reported by Granat *et al.* (1976) we calculate 6×10^6 kg S from natural sources for the land surface of the Federal Republic of Germany, i.e. an amount negligible compared to the industrial emission.

REFERENCES

Ellenberg H. (1971) Integrated experimental ecology. *Ecological Studies* 2, 214.

Granat L., Rodhe H. and Hallberg R. O. (1976) The global sulphur cycle. *Ecological Bulletins NFR (Stockholm)* 22, 89–134.

Mayer R. (1971) Bioelement-Transport im Niederschlagswasser und in der Bodenlösung eines Wald-Ökosystems. *Gött. Bodenkundl. Ber.* 19, 1–119.

Mayer R. (1972) Untersuchungen über die Freisetzung der Bioelemente aus der organischen Substanz der Humusauflage in einem Buchenbestand. *Z. Pflanzenern. Bodenkunde* 131, 261–273.

Mayer R. and Ulrich B. (1974) Conclusions on the filtering action of forests from ecosystem analysis. *Oecol. Plantarum* 9, 157–168.

Mayer R. and Ulrich B. (1977) Acidity of precipitation as influenced by the filtering of atmospheric sulphur and nitrogen compounds—its role in the element balance and effect on soil. *Wat., Air, Soil Pollut.* 7, 409–416.

Ulrich B., Mayer R., Khanna P. K., Seekamp G. and Fassbender H. W. (1977) Input, Output und interner Umsatz von chemischen Elementen in einem Buchen- und einem Fichtenbestand. *Ber. Tag. Ges. f. Ökologie, Göttingen Sept. 1976*, 17–28.

VDI-Berichte (1972) Die Emission von Schwefelverbindungen. *Berichte des Vereins Deutscher Ingenieure* 186, 60 p.

As requested in your form letter, I wish to present to you some additional information relating to the submissions of myself and Mitch Bronaugh and also my recommendations concerning the AL-PAC proposal.

As you are aware, our focus has been on Sulphur deposition rates, soil sensitivity, the filtering effects of forests, and the possible consequences of the AL-PAC operation on Alberta soils. The work I will be presenting points to a dire need for further field work to be done before we make any hasty decisions. This may, in the opinion of some, be uneconomic. However I can only hope that we are wealthy enough as a province to be able to make an educated and informed decision, even if this requires more time.

One thing which has become very clear is that there are no measurements for the area in question. No one can say with any confidence just what the deposition rate is.

Following is a sampling of the other comments and conclusions and recommendations of the people working in the monitoring field in Alberta.

J.M. Mayo, 1987 -- The Effects of Acid Deposition on Forests, Acid Deposition Research Program, vol. 9 -- P. 56; Soils -- Page 68

"5.1 ACID DEPOSITION RESEARCH IN ALBERTA

The considerable amount of acid deposition research in Alberta is varied and detailed. Table 13 gives examples of the research dealing with acid deposition on forests that has appeared in journals in the open literature. There is considerably more in various reports funded by industry and government. No attempt has been made to summarize these. However, as these industry and government papers appear in journals, they will eventually constitute a large body of information. As can be seen in Table 13, and as noted earlier, the major emphasis has been on the effects of S deposition near point sources such as sour gas plants along the Rocky Mountain foothills and the Alberta Oil Sands near Fort McMurray.

There is evidence of soil acidification with aluminum and manganese becoming soluble (Baker et al. 1977;; Nyborg et al 1977; Addison and Puckett 1980; and Addison 1984). However, Lore (1984) found no evidence of soil ph change downwind from a sour gas plant near Pincher Creek, Alberta. This study was on loam to clay loam soils not likely to be sensitive to acid deposition. Clearly, there has been a reduction in photosynthetic capacity of the major tree species near these gas plants (Legge et al. 1978; Legge 1980 et al. 1981; Legge 1982; Addison et al. 1984; Amunson et al 1986; and Legge et al. 1986), and there have been effects measurable at the biochemical level such as chlorophyll destruction (Malhotra 1977; Harvey and Legge 1979). It appears that forest growth may also have been reduced (Legge, 1980; Legge et al. 1984; and Legge et al. 1986). These data and many more that have appeared in the various reports cited earlier clearly indicate that Alberta has a problem caused by industrial pollution sources as well as by non-point deposition from farming activities. This clarification of whether these effects are direct or indirect depends on a better knowledge of basic forest processes; further research is required.

5.2 RECOMMENDATIONS FOR RESEARCH

The following are recommendations for research directions in Alberta.

5.2.1 Integrated Studies and Modelling

Integration is necessary and it is recommended that more integrated studies involving soil scientists, soil microbiologists, plant physiologists, ecologists, and atmospheric scientists be undertaken. A modelling approach would be desirable. It should be understood that modelling cannot be just an attachment to existing research programs, but must be the goal from the out set. This requires that funding be sufficient for the modelling effort, including

the research necessary to provide model input, and the means with which to validate the model in the real world. Too often all of these steps are not undertaken, the result being a model that has not been fully tested. An integrated, model-oriented study of a forest ecosystem on an acid sensitive soil near a known source of acidic pollution is recommended. This also requires that a good control site, free from pollution, be selected, and that fundamental research into basic ecosystem functioning must be supported. The Oil Sands region of northeastern Alberta or the Whitecourt area of west-central Alberta are two possible locations for such a study. In view of the proposed future development of the oil Sands, it is recommended that such research begin now, rather than after expansion has begun."

"In Alberta there is insufficient information concerning the proportions of acidic deposition due to dryfall and to wetfall. There is likewise insufficient understanding of the interactions of these different forms with soil."

Kimberly Sanderson, Environment Council of Alberta, March 1984 -- Acid-Forming Emissions - Transportation and Effects, -- Page 39

"Short range, or local transport (less than 100 kilometres) has been studied in Alberta for some time; however, the methods used have not been consistent, leading to results which are sometimes contradictory and un-reproducible, and often controversial. Despite problems in some Alberta studies, there are data on the harmful effects of SO2 on vegetation; as well, copious evidence from studies elsewhere has shown the effects of acid deposition on both aquatic and terrestrial ecosystems. Such information should provide a note of caution to the regulators and decisionmakers here if environmental protection is to be given a high priority."

P.J. Kociuba, D.A. Faulkner, R.F. Hopkinson, Atmospheric Environment Service, February, 1984 -- Sulphur Deposition Modelling in Western Canada -- Page 37

"However, the many data gaps in the precipitation chemistry data and questionable quality of some of the data made most comparisons invalid or uncertain. The 1978 CANSAP and Alberta PQMP data for western Canada provided an inadequate verification tool for the sulphur budget. No measurements of dry deposition or air concentrations exist for 1978 and comparisons with modelled values are not possible."

Western Canada Long Range Transport of Air Pollutants Technical Committee, December, 1985 -- A Review of Mesoscale Modelling for application to Western Canada --Pages 7 and 8

"No reliable accuracy (uncertainty) assessment has yet been done"

"The third year of the action plan will be taken up with the field study designed during year two. Once data from the field program are available, further model runs should be executed. Field data should then be analyzed and model performance quantified."

NB: This plan has not yet been carried through.

AL-PAC E.I.A. Review Board Transcripts, 1989, 1990 -- Page 7107, Line 7

Concord Scientific Corporation is currently undertaking air monitoring in the Fort McMurray area. They are the main contractor for the O.S.L.O tar sands expansion E.I.A. Although Mr. Caton of Concord Scientific used the figure of 10 kg/ha/yr (from the A.D.R.P.) in his submission on behalf of the Prosperity Environmental Association, he did state that "Nobody really knows what the number is".

Here is a sampling of some studies by authors who did field work whose results seem to differ from the modelled results obtained by the A.D.R.P.

Marvin Nyborg, Alberta Environment, June, 1978 -- "Fate of Emitted Sulphur Dioxide" -- Pages 2 & 3, 63 - 68

- please see attachment number 1

Hua Hsu, and G.W. Hodgson, 1977 -- Process of Alberta Sulphur Gas Research Workshop III, Research Secretariat, Edmonton, Alberta -- Page 263

- please see attachment number 2

In his study, Mr. Nyborg points out, among other things, that total sulphur deposition is a more relevant datum than measurements simply of soluble sulphate. Hua Hsu and G.W. Hodgson support his findings

Furthermore, Jim Lore and Associates, while conducting a study for the Caroline area Gas Development Group in 1988, used only the traditional soluble suphate test in their study.

While the data gathered by the many studies of acid forming emissions and their effects is in no way incorrect, the studies are incomplete. Many important areas of study have been simply overlooked, and many of the results present incomplete and misleading pictures of the true situation -- especially in Northern Alberta.

One thing we do know -- according to the AL-PAC study,the area proposed for the mill site contains very sensitive soils with an extremely small buffering capacity in some cases. We know that Alberta discharges large quantities of possibly acid-forming emissions We know that a loss of treed areas results in an increase of acid deposition over the remaining areas.

Although off topic, I feel compelled to bring to your attention another matter with possibly disastrous implications -- When the modelling work was done on 7Q10 river flows (needed to determine B.O.D.) the data input was based on current river flows with intact forest cover. the trees behave as a kind of a sponge insofar as water runoff is concerned. When the trees are removed, the sponge effect is removed, and as a result, there is a more rapid runoff in the spring, with much lower flows in the winter. This could seriously alter the 7Q10 figures used in the model. Considering the fact that B.O.D. levels are already a major concern fo everyone involved, this is an issue that must be addressed.

Another disturbing aspect of the mill is the question of its socio-economic impact. While being touted as a boon to Alberta, the plant's profits will be diverted outside the province, having only limited benefit for Albertans. Statistics Canada reported in 1986 that 64% of corporate profits in Alberta were going to foreign corporations This is a disturbing trend, which would not be tolerated in any other country, and is a trend which most Albertans would prefer to see reversed, rather than accelerated.

It has been proven time and time again that heavily subsidized mega-projects are seldom in the interest of the taxpayer, and this project appears to belong in the "subsidized" category. The Review Board's own independent panel has noted that the economics benefits of this project will be far less than advertised.

The only recommendation I can make is to put in effect a 3 - 5 year moratorium on the development of this mill, while the proper studies are undertaken. With the rather limited economic benefits to Albertans of the project, we cannot gamble on possible degradation of our land base. We must proceed with extreme caution.

January, 1990

(2) A withdrawal shall take effect

(a) on the date the notice of withdrawal is given by the Minister to the Company, or

(b) where the notice given states that the withdrawal shall take effect at a future date, on the date stated in the notice.

(3) In the event from time to time of any withdrawal or withdrawals of land from the forest management area by the Minister:

(a) for disposition to users other than the Crown except where that use has been designated for exemption by the Minister, the Company shall be entitled to reasonable compensation from the users for any loss of profit or other damage or loss suffered by the Company, including by way of example, but without limitation, damage to timber, improvements, regeneration, forest growth, or to its operations on the forest management area resulting from such withdrawal;

(b) for use by the Crown, and for uses designated for exemption by the Minister, wherein the cumulative net aggregate area withdrawn does not exceed 3% of the net forest management area, the Minister shall determine the compensation and arrange for reimbursement to the Company for the actual loss or damage resulting from such withdrawal to any improvements created by the Company's efforts, but not for any loss of profit, inconvenience nor increased costs reasonably incurred by the Company in harvesting an equivalent volume of timber elsewhere;

(c) for use by the Crown, and for uses designated for exemption by the Minister, wherein the net aggregate area withdrawn on a cumulative basis does exceed 3% of the net forest management area, the Minister shall determine the compensation in respect of such excess and arrange for reimbursement to the Company, including damage to timber, improvements, regeneration, forest growth, or to its operations on the forest management area.

(d) if the administration and control of any of the lands comprising the forest management area is transferred to the Crown in right of Canada, the Company shall be entitled to compensation under subparagraphs (b) and (c) as if the lands were withdrawn for use by the Crown.

(4) For the purposes of applying subparagraphs (3)(b) and (c), the net area for the initial forest management area shall be established and agreed upon by both parties to be effective on the commencement date of this Agreement and shall be recalculated at such time as the "5 year reserve area for second mill" is added pursuant to paragraph 3(4).

(5) For purposes other than applying subparagraphs (3)(b) and (c), the net area shall be adjusted annually on the anniversary date of this Agreement in accordance with all exceptions, additions and withdrawals to the forest management area.

RIGHTS OVER THE LAND

7. (1) Subject to all the terms and conditions of this Agreement the Minister grants to the Company the rights, during the term of this Agreement, to establish, grow and harvest timber on the forest management area on a perpetual sustained yield basis, with such rights to include,

(a) the right during the term of this Agreement to enter and occupy the forest management area for the purposes referred to in subparagraphs (b), (c), (d) and (e);

(b) the right during the term of this Agreement to grow, cut and remove deciduous timber on and from the forest management area;

(c) except as otherwise provided in this Agreement, the right during the term of this Agreement to grow, cut and remove coniferous timber on and from the forest management area;

(d) the right during the term of this Agreement to carry out reforestation and other programs that are approved by the Minister in accordance with this Agreement; and

(e) the right during the term of this Agreement to construct, operate and maintain roads, wood concentration yards and other installations necessary and incidental to the Company's logging and silvicultural operations on the forest management area.

(2) For the purpose of interpreting the Surface Rights Act, or as amended from time to time, the Company is an occupant of the public lands comprising the forest management area.

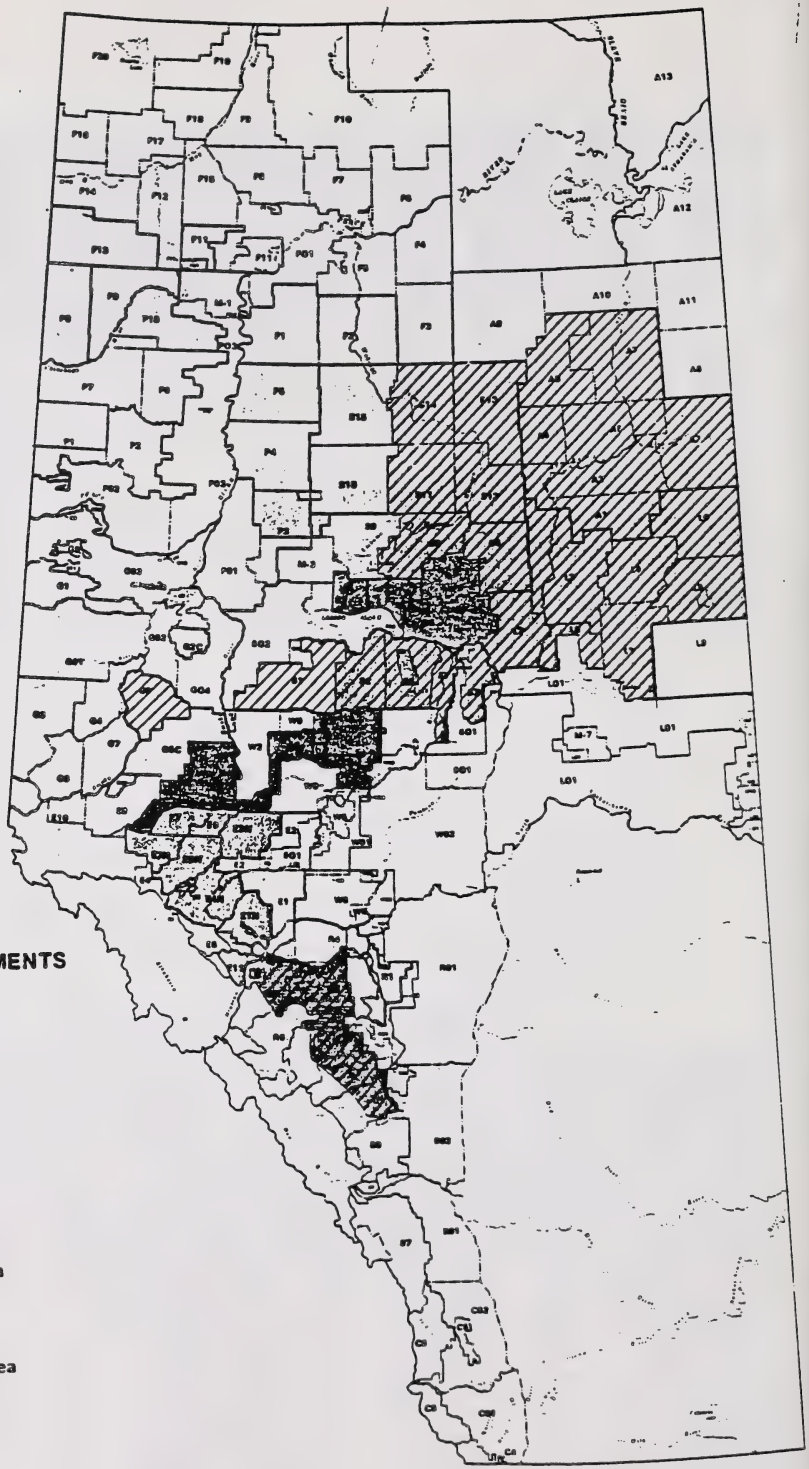
(3) The Minister shall cause land dispositions required within the forest management area for work such as roads, bridges, and other necessary works incidental to the Company's logging and silvicultural operations to be issued to the Company without any dues, fees or rental charges being paid but such dispositions shall otherwise be subject to any pertinent regulations.

(4) Notwithstanding subparagraph (1), the Company may obtain sand and gravel needed for its operations under this Agreement from any vacant public land on the forest management area pursuant to the Surface Materials Regulation, subject to the payment by the Company of all required fees and royalties. In no case, however, shall the Company have to pay fees or royalties for in situ right-of-way material located and used where it is found within the right-of-way.

8. (1) It is recognized by the Minister that the Company's use of the forest management area for growing and harvesting timber is to be the primary use thereof and that it is to be protected therein, but in keeping with the policy of providing for multiple uses of the same public land, the Minister reserves all land rights on the forest management area not specifically given hereby, including by way of example, but without limiting the generality of the foregoing:

(a) the right of others to travel, hunt, fish and otherwise use the said lands for recreational purposes, subject only to any necessary restrictions approved by the Minister for the purpose of prevention of accidents, fire control and seasonal protection of roads;

(b) the right to authorize any person to conduct any work in connection with or incidental to geological or geophysical exploration pursuant to the Mines and Minerals Act, or the Exploration Regulation; provided that the Company shall be entitled to reasonable compensation, from the person conducting the exploration, for any loss or damage suffered by the Company and resulting from such exploration including by way of example but without limitation, for any damage to timber, forest growth, regeneration, improvements



EXISTING & PROPOSED
FOREST MANAGEMENT AGREEMENTS

- Indicates Proposed FMAs

- Procter & Gamble
- Canadian Forest Products
- Weldwood (Hinton)
- Weldwood (Slave Lake)
- Alberta Energy Company
- Slave Lake Pulp
- Slave Lake Pulp Reserve Area
- Weyerhaeuser Canada
- Daishowa Canada
- Daishowa Canada Reserve Area
- Alberta Pacific
- ANC Timber
- Sunpine

Proposed F.M.A. Boundaries subject to change.

February, 1990

Alberta's Oil Sands Reserves And Their Evaluation

By C. P. OUTTRIM, and R. G. EVANS,
Energy Resources Conservation Board,
Calgary, Alberta

ABSTRACT

Estimation of crude bitumen in place in Alberta's oil sands deposits is a function of the method of evaluation and the criteria applied (e.g. minimum saturation cut-off). These, plus economic and other factors, contribute to the evaluation of recoverable reserves by mining or by in situ methods. The paper describes the reserves estimates carried by the ERCB and the evolution over a number of years of the methods and criteria employed.

Updated estimates for each of the eight designated oil sands deposits, plus estimates for the Permian, Mississippian, and Devonian carbonate "oil sands" accumulations, are provided. Where surface mineable reserves are believed to exist the ERCB method is described and "surface mineability factor" maps are displayed, which show relative attractiveness of various areas for this exploitation method. A discussion is included regarding the grade and extent of oil sands deposits required to support in situ *recovery schemes and recovery estimates are made for steam flooding. The effects of external constraints such as environmental requirements are discussed.*

Where opportunities exist to compare the ERCB methods with those applied by various industrial estimators, this has been done.

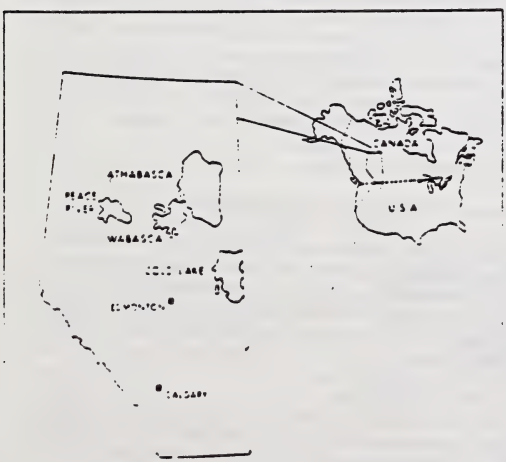


Figure 3a. Location and Extent of Major Oil Sands Deposits in Alberta, Canada.

1. INTRODUCTION

The Alberta Oil Sands Deposits have been delineated through the evaluation of data collected on some 8,000 drill holes. Those deposits occurring in sands of the Cretaceous Period are categorized according to the geographical area of occurrence and by geological unit, as follows:

Geographical Area	Formation Name
Athabasca	Wabiskaw-McMurray
Peace River	Bluesky-Gething
Cold Lake A	Grand Rapids
Cold Lake B	Clearwater
Cold Lake C	McMurray
Wabasca A	Grand Rapids
Wabasca B	Wabiskaw
Buffalo Head Hills	Bluesky-Gething

In addition, there are some large accumulations of crude bitumen in carbonates of the Devonian, Mississippian, and Permian Periods which underlie the Cretaceous accumulations in north central Alberta. In place reserves estimates have been prepared for each deposit on the basis of reservoir mapping, taking into account fluid saturations, porosity, and formation thickness. The Energy Resources Conservation Board (ERCB) until this date has recognized as proved recoverable reserves only those in the parts of the Athabasca area where deposits underlie less than 50 metres of overburden. However, in the opinion of the authors, gradual improvements in our understanding of the technology for *in situ* recovery of crude bitumen from the deeper deposits now enable us to estimate the potential recovery from them, admittedly with only a "first approximation" level of confidence in the accuracy of the estimates. In the case of the surface mineable deposits of oil sand, a summary of reserves criteria used by the Board, GCOS, and Syncrude, and proposed by Shell, Home, and Petrofina, as well as an economic evaluation entitled the "Break-Even Stripping Ratio", are reviewed. An evaluation of reserves using the present ERCB method entitled the "Surface Mineability Factor", is presented. The overall efficiency of surface mining projects is discussed.

With regard to reserves recoverable by *in situ* methods, a number of different methods are discussed and the authors have prepared a detailed evaluation of recoverable reserves by steam flooding. Each of the major Alberta deposits of oil sands has been evaluated using theoretical techniques which relate the heating value of the produced bitumen to the amount of energy that is required to produce it. This factor we have called the "Thermal Ratio", and maps are presented illustrating its value and thus the relative qual-

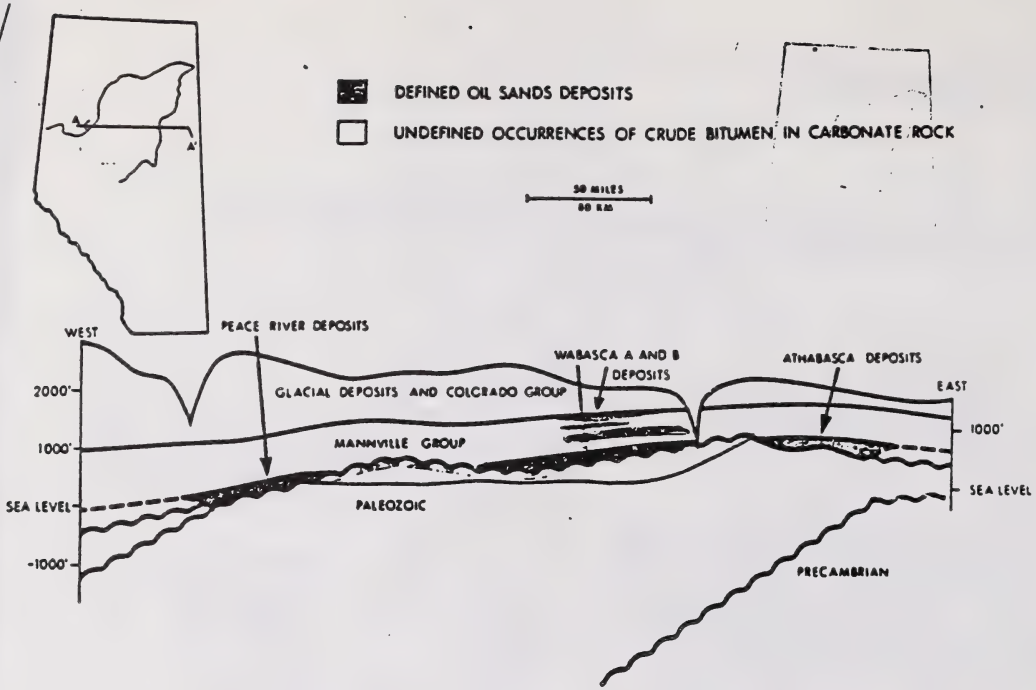


Figure 3b. Schematic Geological Cross-section Along A – A'.

ity of various areas within each deposit. The reserves which can be recovered as a function of the minimum acceptable "Thermal Ratio" have been calculated and a probable recoverable reserve is presented. The ERCB has not had sufficient time to review this evaluation and therefore does not now include these reserves in the proved recoverable category. In any case it looks forward to adopting it, or an alternative, in the future and may choose to await the commencement of a commercial *in situ* recovery project before recognizing such reserves as "proved recoverable". Therefore the reader is asked to bear in mind that responsibility for the material presented in this paper is entirely that of the authors, and not the ERCB or any other organization. A general review of the criteria employed by industry to define the potential for recovering crude bitumen from these oil sand deposits is presented.

The steam flood method was selected for estimation of recovery from the Cretaceous deposits not because the authors believe no other recovery method is feasible, but rather because more information is available on which to base the calculation of energy requirements, heat losses, and recovery efficiencies. For those portions of the Cretaceous deposits apparently not amenable to steam flooding, it has been assumed that other unspecified methods of recovery will be applicable. Lack of time and lack of technical development prevent any detailed evaluation, but a nominal estimation of recovery has been attributed to them.

In addition, there are some large accumulations of crude bitumen in carbonates of the Devonian, Mississippian, and Permian Periods which underlie the Cretaceous accumulations in north central Alberta. These accumulations have been very sparsely explored, but on the basis of the limited available data and some broad judgements, in place reserves estimates have been made.

Much extensive research and field experimentation remains to be done before definitive calculations of recovery are possible on the Paleozoic reserves, but we believe it is likely that some portion of this crude bitumen will ultimately be recovered. Without intending to convey any pessimism, we have chosen to make what we consider to be a very conservative estimate of the recovery factor.

Environmental constraints for surface mining operations, underground mining operations, and *in situ* operations are discussed. The authors expect that, with the anticipated development of a computerized oil sand data file, reserves determinations will be available with a minimum of delay and will employ criteria which will result in the best determination of reserves. It will be possible to draw comparisons of exploitation methods and to generate a development strategy for Alberta's oil sands.

2. DEFINITIONS

Part of the purpose of this paper is to provide clear statements as to what is being evaluated and what assumptions are involved so the reader may confidently compare this information with other deposits or other estimates. In order to accomplish this, definitions as used by the ERCB, together with some enlargements and explanations felt helpful by the authors, follow.

2.1 *Crude Bitumen*

Crude bitumen is defined as a naturally occurring viscous mixture mainly of hydrocarbons heavier than pentane that may contain sulphur compounds and that,

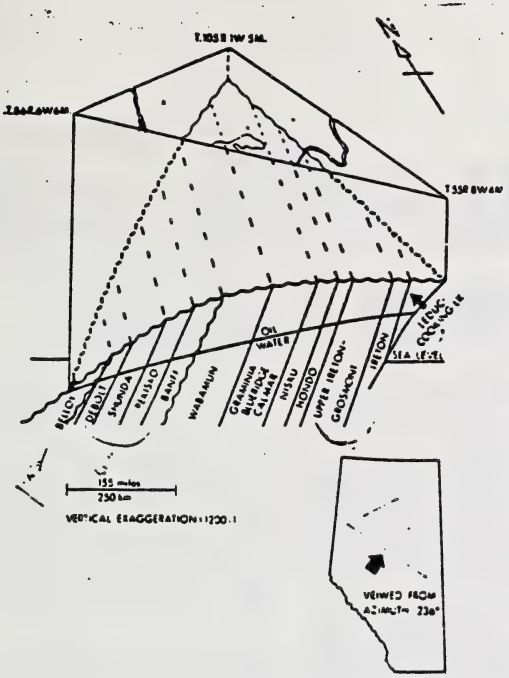


Figure 3c. Three Dimensional View of the Carbonate Oil Sands Deposit.

in its naturally occurring viscous state, is not recoverable at an economic rate through a well. Generally this material has a density of 986 kg/m³ (12° API) or heavier.

2.2 *Oil Sands*

Oil sands are sands and other rock materials which contain crude bitumen and other associated mineral substances. (This definition does not define the type of rock material and suggests that oil sands may be other than clastic sediments and can be loosely interpreted to include all rocks which contain crude bitumen. The huge volumes of carbonate reservoirs which contain crude bitumen can then be called oil "sands").

2.3 *In Place Reserves*

The in place reserves consist of the total resource in a deposit less any portion of it deemed unrecoverable by any foreseeable technology or under any foreseeable economic circumstances. Elimination of sands having a crude bitumen saturation below some minimum cut-off illustrates the concept.

3. IN PLACE RESERVES OF CRUDE BITUMEN

3.1 *Cretaceous Accumulations*

The sedimentary rocks of the Cretaceous Period are derived from clastic materials generated in the Canadian shield area lying east of Alberta and the rising highlands of the cordillera to the west. From these two widely separated source areas the sediments were transported into the Alberta Basin by fluvial (stream) processes where they were deposited in a variety of continental deltaic and marine environments.

A large portion of the heavy oil sand deposits of Alberta are contained within the Lower Cretaceous Mannville group which has been subdivided into McMurray, Clearwater, and Grand Rapids formations. The Peace River Deposits occur in sands equivalent to the McMurray which are referred to as the Bluesky and Gething formations. The map of Alberta, *Figure 3a* indicates the location of the major oil sand deposits. The relationship of these units and the location of the major oil sand deposits are shown in the generalized cross-section, *Figure 3b*, which extends from the western border of the Peace River Deposit to the eastern limit of the Athabasca Deposit, just south of Fort McMurray.

3.11 Peace River Area

This deposit is located in north-central Alberta as shown on *Figure 3a*. The crude bitumen reserves of the Peace River area occur in the Bluesky and Gething formations of Lower Cretaceous Period. These formations comprise a clastic sequence lying unconformably on subcropping strata of Jurassic, Permian, and Mississippian Periods. The sequence pinches out against Mississippian carbonates to the northeast with the Bluesky sediments onlapping those of the Gething Formation. Depth of burial ranges from 450 metres (1500 feet) to 800 metres (2600 feet).

Structurally, the deposit is simple, with the upper Bluesky contact dipping southwest at approximately 4 metres/kilometre (20 feet per mile). The reservoir sands are progressively less saturated with crude bitumen and more saturated with water downdip from the pinch-out edge.

The Bluesky formation consists of well sorted and generally well developed, fine to medium grained, glauconitic sands interpreted to be either a marine facies equivalent to uppermost foothills Gething beds, or a marine reworking of Gething sediments.

The Gething formation consists of poorly sorted, discontinuous sandstones interstratified with shales and siltstones. Minor coal and chert-pebble bands occur in the section. The formation is interpreted to have a westerly source and to have been deposited in an alluvial plain environment.

The massive sands of the main trends are loosely consolidated to unconsolidated with some porosities exceeding 30 percent and averaging 27 percent for clean, well sorted sections. Sands away from the main trends are discontinuous, shaly and show varying degrees of compaction. Porosity for these sands averages 23 percent. Crude bitumen saturations vary considerably, but may exceed 80 percent of pore volume for well saturated sections. The density of the crude bitumen is also quite variable with typical values being in the range of 1030 to 986 kg m³ (6° to 12° API).

3.12 Wabasca Area

The Wabasca A and B Deposits are located in northeast Alberta, as illustrated in Figure 3a.

The Mannville strata of the Wabasca area are underlain by Paleozoic strata of the Grosmont, Winterburn, Wabamun and Banff formations. Remnants of channels have been instrumental in isolating Paleozoic strata favourable for the accumulation of hydrocarbons.

The McMurray formation, an erratic and discontinuous distribution of sands and shales, resulted from a deposition that filled the erosional channels. Crude bitumen deposits within these sands are of minor importance.

The Clearwater formation constitutes a sequence of sands and shales which are approximately 120 metres (400 feet) thick. The lower-most glauconitic

Drilling costs soar in forest lands

By David Climenhaga
(Herald writer)

Energy companies are paying as much as 10 times what they once did to drill for oil or gas on land inside Alberta's massive new forest management agreement areas, says a spokesman for the Independent Petroleum Association of Canada.

Richard Hillary said Tuesday that Alberta regulations governing land use in the massive new FMA areas given timber companies have enabled the lumbermen to charge up to 10 times as much in compensation for trees cut by oil companies as the government used to demand for the trees.

That, in turn, has resulted in a 10-fold increase in some drilling costs, especially to the junior exploration companies that are usually in the forefront of activity, said Hillary, IPAC's general manager of crude oil and natural gas.

Even the cost of seismic exploration for oil or gas can almost double, he said, and the energy industry is not happy about it.

Eventually, he warned, the situation if unchanged could reduce exploration activity.

But while juniors may be bearing the brunt of the high fees charged by some timber companies with FMAs, larger companies are also very concerned about the situation, said Hans Maciej, vice-president of the Canadian Petroleum Association.

As a result, he said, representatives of the energy industry expect to hold meetings with provincial Energy Minister Rick Orman and Forests Minister LeRoy Fjordbotten in February "to come to a rational solution."

The issue was raised by provincial Liberal energy critic Sheldon Chumir, MLA for Calgary-Buffalo, who accused the province of neglecting the interests of the energy industry when it entered into the FMAs.

Chumir said Tuesday that he has received complaints from energy companies carrying on activities in the province's 172,000 square kilometres of FMA land that some timber companies are "levying unreasonable charges."

"All the leverage is on the side of the forestry company in the event of a dispute, since the short drilling season (three to four months) in many FMA areas forces the energy company into a quick settlement," he said.

Hillary agreed. Because of the short time available, he explained, "you're forced to come to some sort of compromise agreement even if it means compromising your interests."

When oilmen cut down trees to make way for drilling or exploration, they have no objection to paying fair compensation to the forestry companies licensed to manage and harvest that timber, he said.

The problem is mainly that wording of the FMAs "is so tight and comprehensive (that) they can walk away with charging what they want."

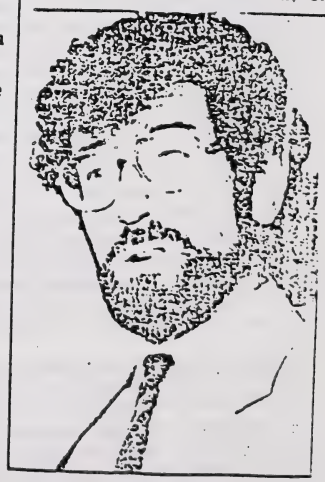
In addition, he said, the compensation schedule may not fairly set the value of low-quality species such as aspen.

As things stand, he complained, to get permission from the timbermen to enter FMA land, oil companies must agree to pay compensation for the timber, cut it and "haul it to their mill site and essentially give it to them."

So, while "we're prepared to pay that compensation," the oilmen object to in effect paying twice or more for the timber they destroy.

In the planned talks with the province, the energy companies hope to come up with a fairer schedule of timber compensation rates, Hillary said.

But the ultimate aim, said Maciej, will be "to come to a policy decision that allows for the efficient operation of both industries."



CHUMIR: Raised issue

CALGARY HERALD

JAN 31 1990

ESTIMATION OF AOX VOLATILIZATION RATES FROM ACTIVATED SLUDGE EFFLUENT TREATMENT SYSTEMS OF BLEACHED KRAFT PULP MILLS

by Mitch Bronaugh

ABSTRACT

For several years pollution concerns regarding bleached kraft pulp mills have focused on the discharge of chlorinated organic compounds resulting from the use of chlorine compounds as bleaching agents. Industry responses to the problem include the use of better digesters and oxygen delignification to reduce the liglin content of the pulp before it reaches the bleach plant, increased substitution of chlorine dioxide for molecular chlorine, and adoption of activated sludge effluent treatment systems capable of removing forty to forty-five percent of the AOX from the effluent. This paper concerns the AOX which disappears on its way through the effluent treatment system. By estimating the rates of volatilization from the various components of the activated sludge system, it can be shown that volatilization may be the dominant AOX removal mechanism in many cases.

BACKGROUND

Biological treatment of pulp mill effluent was originally undertaken to reduce its biological oxygen demand by microbial action, and for this it has been effective. Coincidentally the same systems are found to remove thirty percent or more of the AOX from the effluent. Although it was initially thought that the bulk of this reduction was due to microbial activity, recent studies of bleached kraft pulp mill activated sludge effluent treatment systems have found that only 1.5% to 3.5% of total AOX is found in the sludge (Frostell 1988; Skogman 1989). This shows the fraction of AOX associated with settleable particles due to sorbtion or metabolism is very low, and the great majority of removed AOX must be accounted for some other way. It is not difficult to find statements in the literature to the effect that most of the removed AOX must be dehalogenated by microbes in the aeration basin. Since firm evidence is lacking, these statements seem to be based on the assumption that the removal is caused by the microbes: in the absence of other possible microbial pathways, dehalogenation is presumed to be the explanation by process of elimination.

DISCUSSION

Another mechanism for AOX removal is volatilization from the effluent treatment system. That volatilization plays a role in AOX removal is a matter of general agreement, but it is often incorrectly assumed that its importance will be limited to a few chemical species, such as chloroform, which have relatively high vapour pressures. Published reports of field measurements of AOX volatilization from bleached kraft mill effluent treatment

systems appear to be entirely lacking; until recently, even suitable procedures for measurement were not to be found in the literature (Esplin, 1989).

Volatilization of a non-polar organic solute from water is controlled not only by the vapour pressure of the substance in question, but also its molecular weight, solubility in water, and the nature of the air-water interface through which it must pass (Thomas, 1982). For estimation of environmental volatilizaation rates, the approach generally used is to consider the problem as a series of transfer regimes: first, turbulent movement of water maintains a more or less uniform solute concentration throughout the water body except near the surface where a thin stagnant layer exists in contact with the air. Second, individual molecules of the solute diffuse through the stagnant water film. Third, the solute moves through a stagnant air film in contact with the surface of the water, also by molecular diffusion. Fourth, the solute molecules emerge into the region of turbulent air mixing and transport. Since resistances in the second and third stages dominate, this is generally referred to as the two film model (Thomas, 1982).

Propensity of any non-polar organic substance to volatilize from water is largely determined by its Henry's law constant, H, which describes the equilibrium partitioning of the solute between the air and the water, much as the vapour pressure describes the equilibrium partitioning between the pure substance (solid or liquid) and the vapour phase in the air above it. For compounds with values of H lower than about 2 Pa m^3/mol, resistance of the air stagnant film dominates, as low concentration in the air means relatively few solute molecules can be diffusing through the stagnant air film at any one time. Suntio et al (1988) show that neutral AOX compounds generally have values of H between 100 and 1000 Pa m^3 /mol, and should therefor be regarded as highly susceptible to volatilization, since the air film diffusion resistance in this range is only about one tenth the liquid phase resistance (Thomas, 1982). Regarding non-neutral AOX species, Suntio et al state "The phenols and acids appear to have H values of 0.1 to 2, thus volatilization from water is not expected to be an important process, except under conditions of intense air-water contact, as occurs, for example during aeration processes." (Suntio et al, 1988). Aeration processes characterize activated sludge effluent treatment systems.

In the case of relatively fresh air moving over a heavily polluted water body (which describes the case with a pulp mill effluent treatment system), the flux, or rate of volatilization per unit area, is equal to some overall transfer rate KL times the concentration of solute in the water. Total resistance to water-air transfer is the sum of the resistance of the stagnant

air film plus the resistance of the stagnant water film, and the overall transfer rate constant KL may be seen as the reciprocal of the overall resistance. and is analogous to depositional velocity. Thomas (1982) presents a table of values for KL and Henry's law constants for various organic compounds. Note that the KL value for chloroform is only about 50% higher than for Aroclor mixtures (PCB's), even though its vapour pressure is a million times higher. The KL values presented in this table are useful for comparison of relative rates of volatilization for various chemical species, though actual observed environmental volatilization rates tend to be lower in absolute terms.

Eisenreich (1987) refers to volatilization rates of about 0.24 m/d for PCB's and dichlorobenzene in various large cold lakes. This seems a good starting point for estimating KL values for the different conditions found in effluent treatment systems, by adjusting for temperature etc. Mackay and Yuen (1983) have developed equations expressing stagnant film resistances as a function of Schmidt numbers. Since the Schmidt number is the ratio of kinematic viscosity to molecular diffusivity, and since these two factors governing stagnant film thicknesses are influenced by temperature in known ways (molecular diffusivity approximately doubles for each 20C temperature increase, and viscosity can be looked up in a table), this approach facilitates adjustment of KL for different temperatures, and the predicted rise in volatilization rate is 2.8% per centigrade degree. (Mackay and Yuen, 1983).

It can be shown that Ln(C/Co) = -KLt/Z (equivalent to Thomas's equation 15-11), where C is the concentration of the solute in the water at any time t, Co is the initial concentration, Z is the average depth of the water body, and KL is expressed in units compatible with t and Z. Once the value of KL has been adjusted for temperature, this equation facilitates estimation of volatilization losses for AOX species from various stages of an effluent treatment system for which depths, temperatures and hydraulic retention times are known. (Since any appreciable microbial degradation of AOX species can only occur in the aeration basin, or bioreactor, the equation could be modified to include some biological rate constant as cofactor with KL for estimation of AOX losses in the bioreactor component only.) An exceptional case involves cooling towers, spray cooling, and other processes involving droplets and/or bubbles. Because such systems achieve equilibrium very quickly, volatilization rates will depend on the Henry's law constant H rather than on the diffusion characteristics which dominate equations based on the two film model. For species in question, values of H increase by about an order of magnitude for 25C temperature rise. (Eisenreich, 1987). The fraction of AOX removed by

volatilization during the effluent's transit of the entire activated sludge system can be calculated by obtaining the product of all the fractions retained through each component of the system (C/Co) and subtracting this product from unity.

FACTORS NOT INCLUDED

Some other factors will affect volatilization rates. Because these are difficult to quantify, they are not included in the calculation of estimates, but are discussed as part of the context of the calculations. Because of the probable importance of aeration and turbulence, omission of these factors from the calculation will probably result tin low (conservative) estimates of volatilization rates.

Molecular weight: Diffusivity depends on the sizes and shapes of solute molecules, varying approximately with the inverse square root of the molecular weight. Since the great majority of OX involves species with molecular weights between 100 and 2000 (Skogman, 1989), use of PCB's with molecular weight of about 300 as a standard may result in overestimation of AOX volatilization by around 30%, except in the case of cooling towers and other processes involving equilibrium conditions, which will not be materially affected by variations in diffusivity.

Sorbtion: Sorbtion onto particles (including colloids) greatly diminishes availability of molecules for volatilization. Highest sorbtion rates correspond to lowest temperatures, and the lowest effluent temperatures in an activated sludge effluent treatment system are found in the secondary clarifier. Since less than 7% of the AOX in the secondary clarifier is sorbed to settleable particles, it seems reasonable to expect that the effects of sorbtion will reduce AOX volatilization by less than 20% overall.

Thermal convection: Since effluent temperatures may range from 35C to 60C in different parts of an activated sludge effluent treatment system (much warmer than the ambient air), convection currents in both water and air may be expected to reduce appreciably the thicknesses and resistances of the stagnant films, increasing volatilization rates, especially in relatively quiescent regimes such as clarifiers.

Aeration and turbulence: The aeration and turbulence essential to any activated sludge system increases volatilization by disrupting the air and water stagnant films and by creating conditions of intense air-water contact. The effect of aeration and turbulence is particularly difficult to estimate, but it is probably very large.

CONFIDENTIAL

CONCLUSION

A method for estimating AOX losses by volatilization from bleached kraft pulp mill activated sludge effluent treatment systems has been presented. Application to modern pulp mill proposals indicates volatilization may be the dominant mechanism of AOX removal from such systems. Improvements to the approach taken in this paper await publication of data from reliable field measurements. The importance of addressing the effects of volatilized AOX species on nearby humans and other organisms must be stressed.

REFERENCES

Eisenreich, S. J. The chemical limnology of nonpolar organic contaminants: polychlorinated biphenyls in Lake Superior. In Sources and Fates of Aquatic Pollutants, Hites, R. A. and Eisenreich, S. J. (eds.). American Chemical Society, Washington, DC. 1987.

Esplin, G. J. Pulp and Paper Canada 1989, 90:10, T398.

Frostell, B. Environment-90 report 17, SSVL, Stockholm. 1988.

Mackay, D. and Yeun, A. T. K. Environ. Sci. Technol. 1983, 17, 211-217.

Skogman, R. Presentation at the Third Colloquium on Pulp and Paper Mill Effluents, University of Toronto, Toronto, Ontario, 1989.

Suntio, L. R.; Shiu, W. Y.; Mackay, D. Chemisphere, vol. 17, No. 7, pp 1249-1290, 1988.

Thomas, R. G. Volatilization from water. In Handbook of Chemical Property Estimation Methods: Environmental Behavior of Organic Compounds, Lyman, W. J; Reehl, W. F.; Rosenblatt, D. H. (eds.) McGraw-Hill Book Company, 1982.

A BRIEF

PRESENTED TO

THE CLEAN AIR STRATEGY FOR ALBERTA

JANUARY 10, 1991

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BRIEF PRESENTED TO THE CLEAN AIR STRATEGY FOR ALBERTA

When we look at the ingredients that pollute our air such as CFC's, VOC's, nitrogen oxides, methane, sulphur oxides, ozone, and carbon dioxide the best solution to keeping our air clean is to eliminate these by-products by cleaning up the sources that produce them. This may seem expensive to the companies producing commodities and to the people purchasing them, but the expense down the road to the health of Canadians and the earth ecosystem will be much greater. It will be catastrophic probably; the time to be tough and carry out legislation to cut these emitted substances is now.

I have the following suggestions:

1. The energy industry must be legislated to comply with zero emissions.
2. The best available technology must be the only choice for these industries regardless of cost, because the cost to life down the road will be much greater.
3. Research into zero-emission technology must be a priority, with subsidization by government, or carried out by government with the eventual sale of this developed tenhnology to private companies.
4. Air pollutant diseases are on the rise, such as asthma and will get progressively worse if air quality is not maintained and improved.
5. Alberta, a major producer of gaseous energy-related emissions, must make an immediate political committment to educate people about the problems of emissions into the air and seek their cooperation in conservation and efficient use of all energy consuming products.
   a. information on energy efficient appliances, reduction of electrical gadget use should be available everywhere from supermarkets to book stores to bus shelters.

6. Individuals must be made to see that they play a role in the greenhouse effect and acid rain as well as industry.
7. California auto-emission standards should come into effect immediately on all new vehicles sold in Alberta.
8. Financial incentives should be forthcoming to cities from the provincial government to promote use of mass transit.
9. Penalties in the way of a fuel tax, tire tax should be administered on all vehicles used for commuting to and from work by office workers on major public transportation routes. This might be an administrative challenge but couldn't be worse than the GST administration mess.
10. Alberta should be lobbying the Federal government to increase rail service for people and goods and discourage truck transport of goods and individual use of motor vehicles by the travelling public. Bus service for goods and people should also be encouraged and improved.

11. Increased price means decreased use and conservation: therefore, all energy consuming products should be subject to a "green tax" at the time of purchase. However, <u>all</u> this money should be used to finance research, conservation and education in energy efficient procedures and devices and technology.

12. People, industry and government must change their way of life. People must be willing to have less gadgetry and carry out non-consumptive lifestyles. Industry must be willing to install and pay for the best technology available towards the zero-emission goal and more efficient use of energy. Government must be tough in its legislation to see that individuals and industries comply and work towards these goals. Government must regulate itself stringently in the matter of energy conservation and zero-emission goals.

13. Industry and the governments who regulate them must change their attitudes. Right now, industry operates under the policy that they will only comply with the minimum pollution requirements and they fight these tooth and nail. Of course, the reason is money--it costs more to put on the maximum pollution requirements and cuts into their profits. What good are profits if there is no clean air left to breathe? Government can no longer be lax in these matters--best emission control technology must be required. One clear example of this attitude in the area where I live is the OSLO upgrader facility scheduled to be built near Redwater. They are required to remove 98% of the sulphur dioxide emissions by government regulations and so are complying. This seems great but the plant is so big they will still discharge 20 tons of sulphur dioxide (acid deposition and rain) on the land, plants, animals and people every day. For 15 to 20 million dollars (total cost of the plant is 2 billion dollars) extra, emissions could be reduced to zero. This company is not willing to put maximum pollution controls on for another 4% added to the cost of the project. They have stated that costs to reduce emissions is prohibitive; they also stated that if emissions must be reduced to zero for environmental reasons they will take the necessary action. In other words, if they are forced into putting on the maximum pollution requirements they will but they won't do it as a good corporate citizen to protect peoples health and livelihood. Therefore, government must regulate these maximum pollution requirements in all cases.

Barbara Collier

A PROPOSAL TO COMBAT GLOBAL WARMING

Third Edition

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Revised: April 30, 1990

A PROPOSAL TO COMBAT GLOBAL WARMING

EXECUTIVE SUMMARY

This report has two basic parts, the first of which supplies sufficient background information on the causes of global warming to enable the reader to acquire a perspective view. The second part advocates a method of attacking the root of the global warming problem, using an automatic negative-feedback pricing system in a global market with strong capitalistic overtones, and based on direct responsibility.

State of the Earth:

A general description of the planet, as it relates to global warming, is outlined, with details of the major carbon deposits and their traditional roles and cycles in establishing atmospheric gas levels. Environmental damage resulting from a burgeoning civilization is examined, as well as the theory of various cycles and effects. The progression toward two basic conditions is undeniable; a decline in the traditional natural systems which isolate carbon from the atmosphere, is being aggravated by an excess of anthropogenic carbon dioxide emissions.

A few realizations about a rising population determine that both basic conditions must be improved for any possible resumption of stable, familiar gas levels. Even once fossil fuels have been abandoned, atmospheric restorative systems will still have to be maintained.

The Great Social Challenge to Achieve World Consensus:

Extrapolations of present trends are used to view possible future developments, with descriptions of popular and not so well known phenomena. Some scientific views of an uncertain future are briefly explored for both information, and to lend these views credence.

Probable delays to acquiring a mandate are examined, concluding that amongst various nations, material change will not occur without legislation to maintain fairness. The legislation needed is simple and would likely involve the implementation of a carbon tax for most peoples.

Abundant Vegetation Needed for Atmospheric Carbon Removal:

A closer look at forests, some of the many roles they play, and some of the effects of deforestation is provided, including the effects of cattle grazing. Possible future roles of forests are discussed.

Waste Air Management, as an Industry, Must be Established:

Just as solid and liquid waste management are being incorporated into all affairs, so must waste gas management. Payment for atmospheric carbon dioxide removal must be sufficient on a continual basis to ensure preservation of the world's vegetation. Although some nations have expressed willingness to offer financial support, it is necessary for all carbon users to participate for satisfactory results.

Creating a Market for the Waste Air Management Industry:

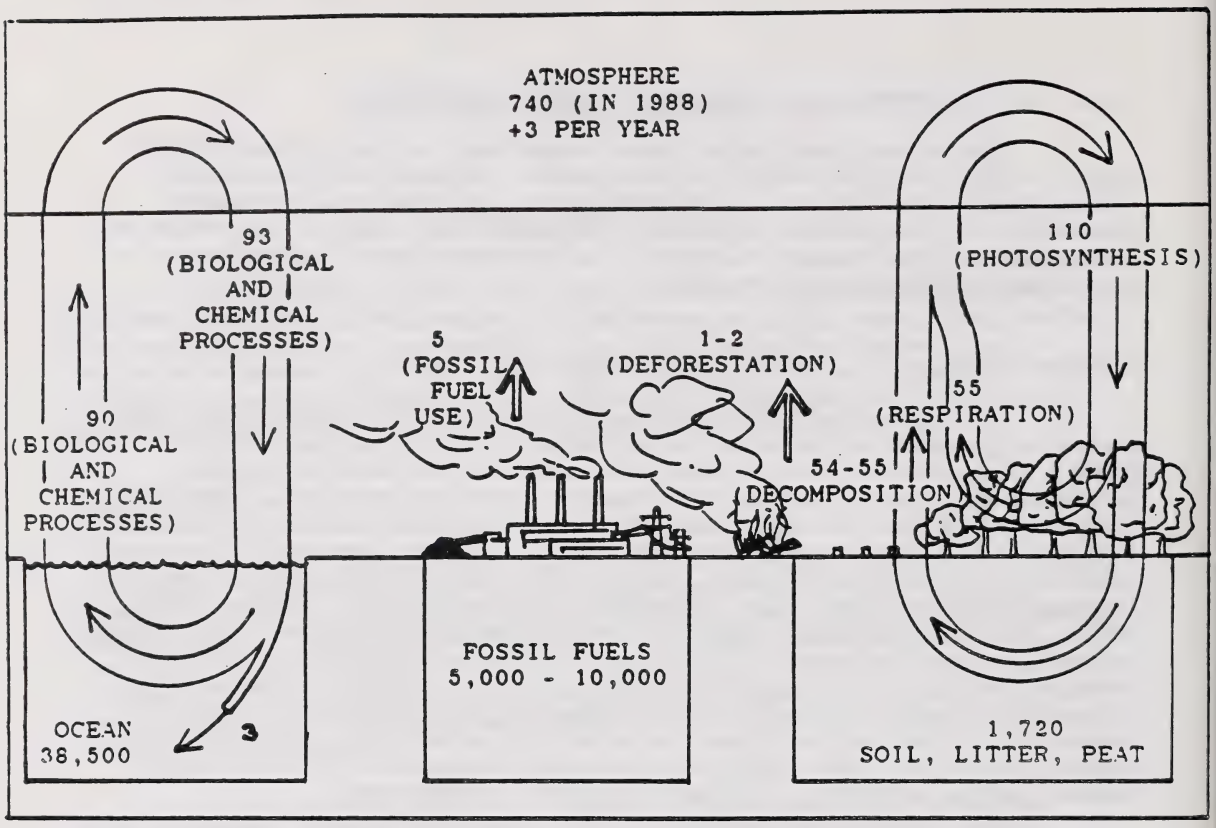
All nations should be assessed for their role in carbon usage, and should be penalized or rewarded accordingly. A world-wide agreement is needed to ensure that the penalties will always be sufficient to pay for scheduled atmospheric restoration. Penalties are to be extracted, based on each nation's carbon emissions, and paid to tree-growing nations according to the carbon that is removed from the atmosphere, at the same rate. This rate, price per unit measure of carbon dioxide, will fluctuate according to demand; the more drastic the need for atmospheric modification, the higher the going price. This will establish a negative feedback system, the surest way to apply constant restorative pressure, controlled by direct responsibility. The only intervention from normal market practices, is the application of desirable atmospheric change quotas, to be established by an international group of economic, political, and environmental scientists, which will in turn, influence demand and price. The objective is to balance atmospheric carbon removal against carbon emissions, in order to achieve a desired level.

A heavy carbon tax, the logical result of an industrial nation seeking to fund its national emission fee, would stimulate fuel replacement with more sustainable energy sources. The two basic differences between this proposal and those being circulated throughout the media, are that: the fee is automatically raised and lowered according to the planet's ability to cope with emissions, and all of the payments are to go directly into financing atmospheric restoration - forest production. Again, the amount of financing made available for forest production will depend on the shortfall, or demand. The market, by virtue of this feedback action, will be self regulating.

Additional Wide Benefits to Consider:

Many benefits can be realized with the use of sustainable fuels and the increased presence of forests, such as the prevention of soil runoff, an almost complete reduction of most air pollution emissions, the preservation of biodiversity, and the expected improvement to rainfall patterns. The benefits are great enough that the morass of current anticipated national and international antipollution regulation and litigation, much of it muddled, arbitrary, and singular in effect, need not be employed.

A further benefit of enormous proportions will result from the reversal of the flow of wealth between the rich industrial nations, and their poorer neighbors to the south. One of the world's richest industries, waste air management through dense forestation, will become largely their commodity to sell.



"Carbon is exchanged between the atmosphere and reservoirs on the earth. The numbers give the approximate annual fluxes of carbon (in the form of carbon dioxide) and the approximate amount stored in each reservoir in billions of metric tons. The existing cycles - one on land and the other in the oceans - remove about as much carbon from the atmosphere as they add, but human activity (deforestation and fossil-fuel burning) is currently increasing atmospheric carbon by some three billion metric tons yearly. The numbers are based on work by Bert Bolin of the University of Stockholm."

Scientific American September 1989

A PROPOSAL TO COMBAT GLOBAL WARMING

I. INTRODUCTION:

This report was assembled on a private initiative, following the intense media coverage on the environmental degradation, throughout the year, 1989.

Purpose and Scope:

The purpose of the report was to explore and publicize an ideological concept, with the aim of stimulating meaningful action against global warming. Much difficulty in achieving a consensus of public realization, motivation, and commitment is expected. The informational part of the report is designed to educate, alarm, and then relieve the reader with a description of a possible solution and course of action.

Background:

"Global Warming" describes a worldwide condition which will become an increasing concern for some decades to come. It is the result of a physical phenomenon, popularly called the "Greenhouse Effect", an expression already cliched in "fashionable" conversation, which describes the increasing insulating properties of the atmosphere, caused by a change in the proportions of its gaseous components.

Solutions for global problems of this magnitude, require that all the world's nations unite their efforts towards the common goal. Fears of the inability of such numerous and disparate societies to unite, are presently very high; "Lack of political will", is the popular phrase. A logical, fair, sensible, and sensitive plan could contribute much to alleviating this fear, and sustaining a vision, direction, and hope.

Sources:

The information provided is so general as to be almost common knowledge amongst environmentalists and earth scientists. There are no new facts or theories employed in his report. Important figures which describe the scope of the problem, are referenced, mostly to the special environment issue of *Scientific American* from September of 1989.

Limitations:

This report was designed to convey an idea. The figures used are nominal only, often hypothetical, and are not intended for use in actual calculations.

II. A GENERAL VIEW OF THE PLANET, EARTH:

The major constituents of the atmosphere, nitrogen and oxygen, allow much of the heat of the sun's energy that strikes our planet to escape back out to space at a rate which keeps the Earth's average temperature at a fairly constant level. However, some of the lesser gases, known as trace gases, tend more to trap the heat, much as the glass does for a greenhouse in colder climes. It is the increase of these more insulating trace gases, primarily carbon dioxide, which is the subject of our attention.

Carbon is an element so inextricably linked to life on earth that it can be observed that: where there is carbon, there is or has been life, and where there is life, there is carbon. Besides existing in the cellular structure of every living organism, there is an estimated total of 51,000 Billion Tonnes of planetary carbon distributed throughout the land, air, and waters[1], which is involved in the biological carbon cycle.

The largest deposit by far lies within the oceans with 80% of the total planetary carbon, amounting to 38,500 Billion Tonnes.[1] A significant portion of this deposit is involved in a vast ecosystem which shares an annual exchange of 93 Billion Tonnes with the atmosphere. Three Billion of these Tonnes are captured as mineral, plant, and animal deposits which contribute to the ocean floor, and to structures like the island of Barbados. A major part of the organically involved carbon is contained in the structures of phytoplankton; a tiny photosynthesis activated lifeform, which is the basis of the oceanic food chain. Other significant fractions exist in the form of calcium carbonate in the shells of all crustaceans, mollusks, and in the skeletal structures of coral, as well as in solution in water. In fact, carbon dioxide being easily dissolved in water, is present in solution in a much higher proportion to other dissolved gases, than its normal .03% or .04% (1/25 or 1/30 of 1%) of the atmosphere.

Should these figures of planetary carbon seem low, that is because they include only that carbon which is involved in the biological carbon cycle; an integral part of Earth's biosphere. Far greater quantities of carbon exists as chemical constituents of sedimentary rock. A larger carbon cycle, known as the geochemical carbon cycle, serves as a long term control that distributes

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

carbon near the surface of the earth, and shares portions of the biological cycles. This larger, slower cycle involves the weathering of rocks by water made acid with subsurface carbon dioxide released from rotting organic deposits, The runoff with the dissolved carbonate and silicate compounds eventually reaches the oceans. In the oceans, the calcium carbonate is used to make shells and bones of marine organisms, which are deposited on the ocean floor after the death of the organism. If the floor becomes buried with tectonic movements and subjected to high enough pressures and temperatures, the carbon will be released to atmosphere via volcanoes and soda springs.

In perspective then, the carbon traces branches of this path: weathered from rock exposed to acidic water, in solution runs off to ocean, in ocean it is incorporated into organisms to be later deposited on ocean floor, eventually to be buried under tectonic movement. If the carbon is later released to atmosphere under pressure and high temperature, it will be used by vegetation and enter the terrestrial biological cycle. The carbon in the decomposing detritus left from vegetation forms carbonic acid with water and joins the rock weathering process to be runoff to the oceans.

It is this weathering process which has brought carbon dioxide levels down from being a major atmospheric constituent, to status of trace gas. Only the emissions from springs and eruptions prevent all the carbon from being incorporated into the earth's crust, leaving enough to sustain life. There can be no hope however, that this very slow geochemical process will play a role in reducing our current greenhouse effect. Whereas gas level changes to the atmosphere due to biological cycles are measured in tens of thousands of years, the effects of geochemical carbon cycles are measured in terms of millions of years.

The next largest carbon deposit, and the most compact, is contained in the underground gas, coal, and oil formations resulting from the fossilization of buried organic material from bygone ages. Estimates of the total fossilized carbon deposits range from the equivalent of 5,000 to 10,000 Billion Tonnes of carbon dioxide which is 10% to 20% of the total planetary carbon. Since much of the heat derived from burning fossil fuels results from the chemical action of the carbon in the fuel combining with atmospheric oxygen, the very concentrated content of carbon in these fuels have made fossil fuels the main tool of industrialization.

The next carbon pool to examine exists just above and below the earth's surface, in the form of vegetation and dead vegetable remains in various states of decomposition, such as humus. This deposit constitutes a mere 3% or 4% of the total planetary carbon, amounting to 1,720 Billion Tonnes.[1] All of these estimates are at this stage only rough. This deposit also shares a cycle of carbon exchange with the atmosphere, involving 110 Billion Tonnes of carbon dioxide due to the respiration and decomposition of

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

plants and plant matter.

The last remaining carbon reservoir to consider is the atmosphere itself. In 1988, this was estimated to contain 740 Billion Tonnes of carbon dioxide, or 350 parts per million.[1] Its presence in only trace amounts in the atmosphere, allows a significant proportional change with the addition or removal of just a few Billion Tonnes of carbon dioxide.

Historically, atmospheric gas levels were maintained by natural processes involving growth and decomposition of vegetation, climatic cycles and ages influenced by orbital eccentricities, geological and cataclysmic events, and many other factors and relationships which have not yet been fully understood. It is unclear which is more cause and more effect, but records have shown that there is a direct relationship between Earth's temperature and the atmospheric levels of CO_2. The rate of rise and fall of carbon levels in the air has always parallelled the fluctuations of temperature during the last couple of hundred thousand years. Although these fluctuations have been large, the time spans involved are measured in thousands of years.

III. SPECIFIC ENVIRONMENTAL DAMAGE IDENTIFIED:

A more abrupt change in gas levels can be traced to shortly after the beginning of industrial mechanization, and with the spread of civilization across all habitable continents. The rise in trace gases was relatively gentle until the pace of industrial expansion, and the exploding population characteristic of post war conditions, have forced the climatic issue to prominence.

In general, atmospheric gas level balance is maintained and affected by the influence of a variety of positive and negative reinforcing elements. As a system overbalances in one direction or the other, a positive reinforcement will add to the trend and increase the change further, while a negative reinforcement will act against the direction of movement, as a stabilizer. It is largely the action of these reinforcing effects which will determine the state of the atmosphere.

Not so long ago, say 50 or even just 20 years ago, the planet did have a better capacity to reabsorb the carbon that civilization had liberated in the form of carbon dioxide. However, in the past few years, the recovery systems that did serve to maintain normal atmospheric gas levels, have been removed or so decimated as to be rendered largely impotent or nonexistent. Dwindling tropical forests and coral reefs are examples of the degradation of

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

restorative systems. The problem is twofold: while polluting emissions have increased dramatically, the balancing counter forces have been hugely destroyed. The balance of positive to negative reinforcing elements has been altered severely in such a way as to accumulate greenhouse gases.

Assessing the state of the oceans and their exact role in the distribution of the world's carbon supply is difficult and remains largely unexplored. Meaningful conclusions have been simple, sketchy, and speculative. Considering oceans only as physical bodies of water, exclusive of life and its processes, will likely find them to be very stable reservoirs of carbon dioxide merely due to the immense mass involved. However, because of the vast complexities of currents and varying mixing rates, most of which remain uncharted, it is impossible to judge the role of the oceans with any realistic confidence.

Some prime arguments center around the oceans' ability to dissolve carbon dioxide as the temperature and gas levels rise. Higher concentrations of atmospheric CO_2 will tend to force more gas to dissolve in the water. But, this may well be balanced or even overcome by the reluctance of heated water to accept dissolved gases. It would seem that any water close enough to the surface to dissolve more carbon dioxide, will likewise be warmed by the higher temperatures.

As an ecosystem, the oceans have been very effective in helping to keep atmospheric carbon levels lower. Invigorated life processes serve to involve much carbon dioxide which would otherwise be released to the atmosphere and which also fix, in a more permanent fashion, a further 3 Billion Tonnes of carbon dioxide in the form of sediments and deposits. In the absence of suitable currents, the lowest oceanic levels received carbon dioxide from the bacterial action on dead organic tissue which has drifted down from the surface layers. This action of bringing surface carbon down to the lower water levels is sometimes referred to as a "biological pump", and allows greater volumes of the oceans to act as a carbon "sink". As such, the oceans have been an everconsuming absorber of carbon. However, these life processes, and the carbon they trap, are entirely dependent on the health of the oceans. Reduce the life processes, and less carbon from decomposing tissues will be deposited on the ocean floor, or biologically transported to the lower marine levels.

Lately, the oceans as an ecosystem, have been suffering. Coral reefs are on the decline. Since coral quite happily grows upon itself, theoretically the reefs could have been if allowed to, constantly expanding, constantly pulling carbon from the sea and adding to the deposit, not merely maintaining a balanced cycle. But, most of the world's reefs have been severely wounded, some mortally so. They have been choked on the effluent of human activity, dredged for harbours and boatways, sealed off by bridges and causeways, buried under the silt of erosion run-off from deforestation which is often laced with agricultural chemicals, poisoned and blown to bits by tropical fish collectors, broken and picked apart by souvenir hunters, and made to suffer many other assaults not mentioned here. As it is, reefs are less and less adding to themselves and supporting other carbon based lifeforms.

As net consumers of carbon dioxide, the oceans are quickly fading. Although their great physical mass and the resulting stability will not be easily affected, at their fringes, near where the water meets the land and the depth is shallow, where there used to be thriving "forests" of coral, the crumbling remains are now slowly dissolving.

As long as the oceans remain as a major medium for transportation, and as a dumping ground for unwanted substances, many of which are toxic or diseased, and the dumping remains impossible to police, it is difficult to imagine marine life increasing from the present.

The terrestrial pool of carbon, consisting of plants and plant matter, is more familiar to us, and its character can be verified in all our surroundings. Carbon is an essential element in every cell of anything that ever grew out of the ground. An amount of carbon equal to about 7% of this pool, is exchanged annually with the atmosphere through living respiration processes and the decomposition of dead matter. This terrestrial pool contains more than twice the carbon contained in the atmosphere.

Since the onset of civilization and its land clearing practices, the terrestrial carbon pool has been continuously shrinking. The shrinkage was relatively inconsequential until about the time of the Reformation in the 1500's. Discoveries, both geographical and scientific, lead to colonization and the expansion of land settlement, and started the population rise on an ever increasing spiral. Any carbon that is removed from this pool is eventually released to atmosphere, quickly as the product of burning, or more slowly as the product of decay. Removal of living matter from the soil not only subtracts directly from the terrestrial pool, but also reduces some of the ability to involve a portion of the atmospheric carbon in a life cycle.

The rate of reduction in vegetable deposits varies according to the degree and method of deforestation. Any burning results in the immediate release of carbon dioxide as a byproduct. If a forest is cut, the lumber won't release its carbon until it decomposes, which could take centuries, depending on the disposition of the wood. The application to which the newly deforested land is devoted will determine the rate of decomposition and the resulting release of carbon dioxide of the remaining detritus, humus, or other surface or subsurface organic deposits. If a new forest begins growing immediately, there will be little release from the subsurface remains since these remains will serve to fertilize the new forest and its respiration cycle.

The worst case scenario, or highest destruction rate, can be witnessed with the current deforestation of the Amazon region. The forests are burned as completely as possible to clear the land. This stops the chemical exchange between the subsurface nutrients and the trees above. Then the tree roots are pulled, or allowed to decompose, exposing the soil to devastating erosion. The soil, no longer being supplied the detritus from the thriving, dense jungle which has been cleared, loses its nutrients. The growing of crops hastens the depletion because a harvested crop leaves little behind, and nothing is returned to the soil. The soil quickly becomes sterile and unable to produce a crop; none is grown there again, and the erosion intensifies in the heavy rains. To the rest of the world, it means that all of the carbon , which is a substantial amount in a tropical forest, previously

locked into the above ground and subsurface material associated with the cleared forest, has been released into the atmosphere ... and gone is the ability to grow new vegetation which would trap and retain additional atmospheric carbon dioxide.

Much of the world's forests have been razed to accommodate man and his single minded ambitions of short term, self gratification. It is only in the last few years however, that serious deforestation attacks have been made on the tropical rain forests; the "lungs of our planet", to use one of David Suzuki's expressions. It is amusing to carry that metaphor further, likening the atmosphere to blood - the transporter of oxygen and carbon dioxide, the sun's heat and thermal expansion to the pumping action of the heart, etc.. This metaphor quickly illustrates how the failure of one component will eventually lead to the collapse of the whole system.

IV. COMBINED EFFECTS OF ENVIRONMENTAL DAMAGE:

The destruction of many of the world's carbon consuming systems, and the increase of carbon emissions from human activity are combining so that the rate of rise of insulating gases in the atmosphere is climbing at an unprecedented level, hundreds of times faster than exists in all geological records. The current carbon dioxide production rate is now twice the world's carbon fixing ability[1,2], and is rising every day.

That this rise in greenhouse gases is a problem, because the increased insulation will effect a rise in global temperatures, is indisputable. What is often argued is the extent of the temperature rise; how fast the rise, and at what point will the temperature stabilize. The feedback systems, such as the oceans in all their immensity, all function at different time scales, and temperature stabilization may not occur for many decades even if the great carbon cycle can become balanced. The out-of-phase feedback systems will in turn tend to destabilize the balanced carbon cycle keeping all the gas and temperature levels in flux for more prolonged periods yet. During this time, analyses of these conditions will be uncertain, making the decision of which directions to follow very difficult to determine. As earthly inhabitants, and subjects of this strange and accelerating experiment on our planet, it would behoove us to moderate the pace of events before an irrevocable but intolerable situation develops.

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

[2]Minister of the Environment Canada. "The Greenhouse Gases," *Atmospheric Environment Service Fact Sheet.* (1986)

V. BASIC PROBLEM AND SOLUTION, SIMPLY STATED:

To recapitulate then: global warming, being the direct result of an accumulation of greenhouse gases in the atmosphere, can only be prevented by reversing the tendency to accumulate these gases, of which the principal component is carbon dioxide. This reversal can be achieved by reducing the carbon dioxide production, emission, or release to atmosphere, and by increasing the planet's capacity to fix, or entrap and lock, carbon dioxide away from the atmosphere. In accomplishing these goals, most of the other greenhouse gases will also be reduced since their production is often linked to the production of carbon dioxide.

Due to the magnitude of the problem, which can be shown with calculations using the figures and values quoted throughout this text, in order to reverse the carbon gas exchange, the attack to be successful, will have to be made from both fronts. Because of the limited size of the planet, attempts to rebalance gas levels by resolving only one of the two aspects of the problem will never suffice.

Even if all emissions from fossil fuels were to suddenly, if magically, cease, there would still be substantial sources of carbon dioxide. Beside all the traditional natural sources, such as volcanos, lightening-caused forest fires, etc., just the respiration of 5 to 10 billion people alone (a 150 lb, or 68 Kilo, man breathes out nearly 400 Kg of CO_2 a year) produces a considerable amount of atmospheric carbon, and this with no mention of the products of livestock. In fact, livestock have a problem all their own - cud chewing animals spew copious amounts of methane out of both ends as a digestion byproduct. Methane is a much more effective insulator than carbon dioxide but because of its smaller amounts, it is rated as the second or third most important greenhouse gas. (cfc's may be rated as second by some scientists)

Since so much of the atmospheric restorative mechanisms have disappeared (forests and aquatic life), the planet cannot possibly cope with any artificial carbon dioxide production at all. The move to a sustainable fuel is absolutely essential, necessitating the abandonment of fossil fuels. At this point, the ernest desire to save the planet, in many people will be seen to weaken and wane.

VI. A CONFUSED PUBLIC LACKING DIRECTION:

Years ago, in the early 1970's, much of the world contemplated a move away from fossil fuels but, at the time it was due to a fear of dwindling fuel reserves. It is a little ironic that when sustainable fuels are finally accepted, it will be because of intolerable emissions.

There is no way to avoid the fact that pollution controls will incur additional short term costs. The cause of pollution reduction is a rather abstract concept to be readily accepted by investors who are totally immersed in the world of finance and business, and very used to conducting their affairs, unimpeded and even encouraged, in the way they see best; their only

accustomed intent being to maximize immediate profits.

The tendency for business and investors has been to procrastinate. The danger is that this tendency will continue past a critical point; that the decline in the environment will be irreversible and will become progressive, and that if the health of the biosphere doesn't enter a terminal spiral, it will be at best, forever crippled. The thought of all Earth's inhabitants having to expend most of their lives' efforts merely coping with a severe environmental condition, constantly on the brink of further deterioration, is a dismal prospect. Environmental scientists, who are "most in the know", have a frustrating time sounding the alarm. They lose credibility every time their cries of "Ten years left!" are drowned out by accusations that they've been saying the same thing for decades. But, these scientists are not doom-sayers forecasting an explosive end of the world ... they are looking for that point of no return. Discovering that point is not just difficult; it might well be impossible - except in retrospect.

To some degree, the lack of cooperation can be traced to a lack of education. Many of the general public - the voters, and even the "movers", not being particularly trained in the sciences, still believe that astrology and astronomy share equal relevance. Understanding how Earth can be suffering the effects of global warming at the same time that the present orbital cycles indicate the approach of an ice age, will surpass their comprehension. Even if or when the resistance to accept warming theories is overcome, education will still be hampered because the field of environmental protection is so new. Not only is the field new, but unprecedented conditions are always being encountered, the solutions for which have to be extrapolated from uncertain interpretations of a past experience not yet fully realized. It is as confusing as it sounds.

VII. POSSIBLE DEVELOPMENTS IF SITUATION NOT RELIEVED:

Acceptance of global warming theories will not automatically lead to agreement to prevent that warming. Opponents to the need to change will be those industrialists who are most dependent on carbon based fuel, especially those involved with fuel production. Undoubtedly, many theories on the resulting effects from global warming will abound and all ranges of opinion, from "doom and gloom"' to "Hey, things won't be so bad for us ... we might even benefit from a warmer climate" will be proffered, and everything in between.

For every argument denying the warming theory and its expected damage, there will be arguments to support the theory. Hazard proponents will argue that the disruption to rainfall and crop growing patterns will be too extreme to benefit anyone. But, all those arguments will pale in the face of the possibility of runaway warming fueled by several of the positive reinforcing elements, not to mention the continued carbon dioxide and methane production from natural processes.

Of the myriad of reactions to global warming, such as the much-discussed expected rise in sea level, some of the positive feedback systems could compound the warming and accelerate the process quickly. Imagine for instance, a shrinking arctic and the effect on sea levels. One effect would be that the receding snow would reduce the surface albedo (reflective ability) so that more sunlight would be converted to heat to be trapped in our greenhouse. A larger effect however, would result from the melting of the tundra as the permafrost receded. Melted tundra is not unlike bog or marsh, and the decomposition or rotting of which would release vast quantities of methane and carbon dioxide to the atmosphere. If this effect becomes sufficiently pronounced, the process resembles that of an exothermic chemical reaction whereby a chemical change produces heat, and that heat accelerates the chemical change. If the heat is insulated from dispersion, the reactions, one feeding the other, can turn runaway. These kind of hazards are unfathomable in our atmosphere as yet, and must never be toyed with ... a sort of Pandora's Box.

A new school of thought considers global warming to be a necessary precursor to ice ages. As air temperatures rise, so does humidity content. Water vapour has greenhouse properties of its own and a positive feedback system is initiated. Depending on the current state of vegetation on temperate land masses, water runoff may be high and land areas may become parched, as is happening throughout most continents now. As weather patterns shift, much of the cloud cover centers around polar regions producing two primary effects: the albedo effect (reflecting property) is increased so that the sun's rays are prevented from heating the ground, and snow from the clouds begins to pile; a sort of rebound effect has occurred and an ice age is entered.

Normally, it is argued, this cycle is lengthy, relying on thousands of years of leaching of nutrient minerals from the soil through plant growth and other natural processes. Finally, the products of vegetation become too sparse to sponge moisture, the runoff dries the land quickly, water tables fall, and cloud patterns shift poleward where the snow is dumped and the sunlight is reflected away by both cloud and snow. It is expected that only a slight rise in trace gases and their greenhouse effect is needed. The resulting increase in air temperature would permit higher humidity levels, and the greenhouse effect from the additional water vapour would not only push the temperatures higher, but would provide the cloud cover and precipitation over the poles. One of the early indications that would accompany the poleward drift of cloud cover and precipitation, and the growing desertification left behind, is an increase in the violence of storms due to the more extreme air temperatures caused by the concentrations of heat and cold from the pattern change. In the last few years, the planet has been experiencing record setting weather and an increasing number of storms of unusual severity. Some scientists say that this is the signal....

Convoluted and paradoxical as this theory seems, it may fit itself easily to the recorded glacial cycles of the past, and it seems to be gaining acceptance. The curious rebound effect and the reasons for it, seem to explain some of the anomalies between previous theoretical expectations and the development of actual recordings. Proponents of this theory are not perturbed by actual temperature rises being lower than expected. They say

that only a little is required to initiate the water vapour feedback system, which will provide the energy to raise the clouds.

School followers claim that water vapour was the missing ingredient in previous globular study models, and that this correction better explains the empirical data now emerging. Their source of worry is a conglomeration of intertwined factors, a few of which are: demineralization of the soil allowing for only sparse and fragile vegetation which eventually succumb to hot and dry fires, desertification of temperate land masses, greenhouse effect from the burning of the vegetation, depletion of the ozone layer hastening the demise of the "planetary thicket", shifting growth and cloud patterns, and the concentrating of hot and cold areas. They also watch for intensifying and shifting jet streams around which will rage more frequent and violent storms and tornados, where there were few or none before. Their hope is to stop the greenhouse effect before the positive reinforcement of the water vapour really kicks in. By this time, the growing conditions will have been completely disrupted, threatening food and forest production. They know not at what speed all this is to occur. Historical data is no example because, as discussed earlier, conditions are way beyond precedent, and show no signs of moderating. Even presented in this very simplified form, it is indicative of the incredibly complex material relationships that can be involved on the surface of so large an object and its feedback systems, as the planet Earth.

VIII. PUBLIC CONVICTION, ALTHOUGH NECESSARY, IS NOT EASILY ACHIEVED:

Many scientists and environmentalists find themselves in the awkward position of hoping (rather silently, of course) for the occurrence of a minor calamity to bring the point home to everyone, that the time to act, regardless of the monetary costs, is now; and better to hope that it is not too late. The major driving force for this change is no longer to be directed only by the whims of economic opportunists. That is not to say that there will not be many economic opportunities created, or made available, by this shift away from fossil fuels, and many of the details will be handled by economic opportunists. The intent of this proposed change is not necessarily to curtail opportunism, which will still drive the world's economy, but to establish a new order; a new priority, the need for which has not yet become apparent to everybody. It must be clear to everyone that this change is not being arbitrarily imposed to regulate business, but that the seemingly subtle signals from nature must be recognized; the necessity to follow its directives is absolute.

During the latter part of 1989, a news item told of the very high incidence of retinal eye burn which occurred during a passing of an "ozone hole" and although a few people clucked their tongues, no world wide movement was initiated. With no directly responsible party to blame, such as there was with the Bhopal incident, alarm is much more difficult to raise. Probably, the death of a large number of people in a concentrated time and locale, and a lingering threat to others, will be required to stimulate serious legislation or a public boycott against an entire class of industry, or more drastic yet, an entire economic base.

The general public appears to be jaded at worrying over probable world catastrophe from 40 years of cold war. Everyone crossed his or her fingers, held tightly, and prayed that in spite of mounting arsenals, no nuclear device would ever be unleashed to mark the beginning of a cataclysmic end to life on the planet. Until such a device was exploded, any degree of hazard, no matter how great, remained only potential. The attitudes that such potential situations breed must not be allowed to carry over to meet the threat of environmental catastrophe. Presently, the damage to a large degree, has already been wrought and we are now awaiting the ghastly dividends. The view that we have already overstepped the bounds of return, is gaining in popularity. Even among younger people, who tend to be optimistic, such as masters' students in environmental studies, the idea that should the possibility of environmental redemption exist, the political will to marshal the necessary world forces away from diversions cannot be achieved. It is of no small significance that our most hopeful people should find themselves relegated to playing the ancient role of Cassandra.

Another developing dilemma is that maintaining the long term interest of the public, on complex issues which take years to unfold, is nearly impossible. The news stories are bombarded with statements made by anybody who has anything to say about global problems. The dissemination of information will, and should continue. The unfortunate result is that the public is now tired of trying to interpret statements claiming one day that the greenhouse is on, and the next day that it is off and we are entering an ice age. The confusion is distressing and exhausting.

In time, moralistic repugnance will play a role in the social movement for change, and it will help to convert a number of minds. Unfortunately, it will also serve to antagonize other people, especially those with direct conflicts of interest; those often in positions of power. With global problems, those in power may constitute entire nations. It would do us well to try to understand their point of view, if only to gain insight into how better to convert them. On a smaller scale for instance, no one could expect a manufacturer to unilaterally incorporate expensive process renovations without a guarantee of buyer support. On an international scale, no nation wishes to risk economic suicide for the same reasons; and no politician wishes to risk political suicide by campaigning in favour of an agenda which is unacceptable to the voters. However, waiting for a "small calamity" increases to the extreme, the risk of entering a zone of no return and jeopardizing the future of civilization.

Because industry and its customers are unaccustomed to paying the higher, more realistic costs of environmental damage, pollution penalties will at first seem to be artificially created impositions; a far cry from the truth to be sure, but it will feel like that to nonbelievers. Eventually, these costs will be reflected at the consumer level ... if only there was a smooth transition to that point. Federal regulations are needed, and these have worked in the past. In the instance of car exhaust emissions, federal regulations ensured that all manufacturers had to incorporate the new limits at the same time; no one had an advantage. Costs were passed directly to the consumer so that profits did not suffer. Car sales remained steady. That is not to suggest that changing an entire economic base from carbon to another energy source

would transpire with nary a falter in the pace of consumption, but that it can be done fairly. Competition within an industry need not suffer.

The same principle of fairness can apply on an international scale with any nation which agrees to the limitations. The agreement process becomes more complex with more participants, but no more so than with drawing up a trade pact. Much of the smoothness of the change to new rules depends on international consensus and cooperation, which would serve to mitigate unfair competition. If a world consensus were achieved, agreements could be made for the implementation of meaningful emission control timetables.

Surely, one of the greatest hurdles will be to convince all governing powers of the necessity to prevent global warming, even if the dollar cost is high. The cost isn't really that much for the saving of civilization, but it will strain some of the heavily polluting economies; universal conviction will not be immediate. In all probability, the evidence needed to convince recalcitrants will soon be forthcoming, but in the meanwhile, a socioeconomic system should be designed to evaluate and incorporate research material, set timetables, and which would collect and allocate funds. The need to restore carbon dioxide fixing systems must be addressed and this will require agreements and money. By the time worldwide conviction arrives, there won't be a moment to lose ... the deeper the damage, the longer and harder the cure.

IX. FORESTATION AS A FUNDAMENTAL REMEDIAL FACTOR:

As was concluded earlier, even with total industrial and massive domestic carbon emission reduction, remaining effluents of the burgeoning population, combined with natural sources, will still be sufficient to raise atmospheric carbon dioxide levels ... to produce a Greenhouse Effect. Consider again that a grown man breathes out 1Kg. of carbon dioxide every 24 hours, and 5 to 10 billion people (average weight of 60 Kg., or 100 lb.) would emit 1.2 to 2.4 Billion Tonnes just from bodily function alone, supporting livestock not included. Hence, the continued absolute necessity for atmospheric carbon removal, immediately and in the future, even if civilization succeeds in switching to a more easily sustainable fuel base.

There is no machine to filtre or process carbon dioxide from the atmosphere which would not, by its own fuel requirements and material needs for manufacture and maintenance, pollute more than it cleansed. Nature, with the sun's energy, can accomplish this if encouraged rather than deterred. Given the monumental task of effecting a change in the oceans' carbon dioxide absorption rate, the best carbon fixing mechanisms appear to exist in the form of growing vegetation, chiefly tropical rain forests. Rain forests are considered superior because of the high concentration of carbon-trapping organic material that can be supported by a given area of forest land. It is perhaps possible that much denser temperate forests, than presently exists, could also be grown with soil improvement, but that has yet to be developed.

Examining the rain forest does not easily reveal the cause and effect between forestation, rainfall, and river drainage basins; it's a little like "the

chicken and the egg". It is known that the heavy rainfall depends to a large degree, on the presence of the forests, and that the river and its drainage depends on the rainfall, as do the forests. Everything is directly or indirectly dependent on everything else, and the relationship is often unforeseeable, complex, and dynamic. Trying to reinstate a stalled cycle, such as trying to reforest Ethiopia, might prove to be difficult, and very much a case of "an ounce of prevention having been worth a pound of cure". Casual thoughts of resource management's ability to reinstate a rain forest, should the need ever arise, may be largely fantasy. In view of the great probability that the exact conditions to nurture new forests won't be produced or made available at the will of managers and planners, it would behoove us as a civilization, to prevent further deforestation.

Efforts at reforestation may not aim at reproducing a previous condition. Since the specific objective is to capture the most carbon dioxide, development will probably center around this directive. A different forest will evolve, with different incidentals. Perhaps many attempts to control reforestation will be thwarted by shallow minded, hastily concluded planning. Planners may have to bend to accommodate some unforeseen logic of nature, and success will go to those who are best able to read and adapt to actual conditions. In the end, forestry managers may discover that the intricacies of ecologies are too complex to be manipulated. A "hands-off" approach may be the best way, and maybe managers should concern themselves with merely ensuring that the basic growing requirements are encouraged.

As an example of the complexity of all things ecological, consider the topic of forest fires. Such a violent material destruction was once thought to be prevented at all costs which, as information now suggests, was a simplified view. The concept of forest fires must not be considered as being entirely negative; after all, fires have always been around and would have had to be integrally included in the evolution of forests, their inhabitants, and the various living cycles. Some fires are inevitable and some organisms have developed in conjunction with these events. For instance, at least at more northern latitudes, a species of pine would not be able to reproduce were it not for the elevated fire temperatures enabling the seed cones to split open, casting their seeds over the ground. The resulting seedlings are stimulated by the sunlight now able to penetrate where the overhead foliage canopy was denuded by the fire.

Fires have always played a role in forest management, long before the advent of man. This is not to suggest that there was any grand design, but that these fires happened frequently enough that some species of organisms developed to include, or as a result of being able to survive where others didn't, the prevailing conditions caused by the cataclysmic event of a fire. Sometimes, a different ferocity of fire achieves different results. Sometimes, low level fires serve to unclog undergrowth that is threatening to choke "everything else". The taller trees can survive a small fire with just a singeing of the bark and lower branches, and remain as a stately, mature stand.

Perhaps in the future, anthropogenic forest management will improve and be able to direct these fires so that their impact is not so haphazard or random. Perhaps discoveries will show that the apparent randomness is really

under a "Chaotic" influence, whose function establishes a subtle yet integral order, as it does in the structural formation of almost all things and all groupings throughout the universe.

To be sure, all fires spew out discouraging amounts of greenhouse gases. However, forest fires, like volcanos, have always been present, and have always been a major source of carbon dioxide for the pre-industrial atmosphere. These incidents must not be forgotten during any attempts to quantify carbon cycles throughout the world. They will always be with us. One of the unfortunate developments however, is that more and greater fires have been happening recently, likely signalling the onset of desertification.

However necessary, desirable, or just inevitable these natural events may be, they must never be equated to the burning of forests for land clearing. Land clearing is a one-way trip which arrests completely any semblance of an ecological cycle, and liberates the carbon that was previously involved in those cycles ... anathema to global balances. In fact, estimates are that 1 to 2 Billion Tonnes of carbon dioxide annually[1,2]could be prevented from entering the atmosphere if deforestation would cease. It should not go unnoticed that this amount constitutes two-thirds of the estimated carbon dioxide overproduction.

It is not impossible that, as carbon dioxide levels increase, plant growth will extract the carbon at higher rates which, combined with the higher global temperatures, would accelerate their growth rate. This would favour the cooling of the planet, acting as a negative reinforcement; a stabilizing influence, but it must be allowed to happen ... the vegetation must first exist.

Increasing forestation will surely be easiest if forests that are already established are allowed to expand over adjacent territory. Included in the benefits of intensifying forestation, will be the preservation of many species of plants, animals, and even tribes of people. Economic benefits derived from the collection of forestry products, vegetable and animal, like tree sap, foods, medicines, building products, clothing fibres, etc., can be included, both in the planning stages, and in realizing the wealth that more naturally evolved forests can offer. The cries are loud now, to save the Yanomami people, and for the public to buy more Brazil Nuts to emphasize the monetary advantages of retaining these rain forests. These cries would be much fortified if they were augmented by the principle that the growing of high density forests by itself, was a valuable commodity as waste management, worthy of financial compensation.

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

[2]Minister of the Environment Canada. "The Greenhouse Gases," *Atmospheric Environment Service Fact Sheet.* (1986)

Should a reforestation program be accepted, it is important that it be launched as soon as possible; time is of the essence. The longer the delay, the higher the global temperature, and the more hazardous the risk due to effects of positive reinforcing elements, and due to the absence of the main traditional correcting factors ... an abundance of forests and marine life. Also, the longer the delay, the higher the greenhouse gas levels, and the more drastic the corrections needed. It seems entirely possible that the need for increased forestation may impinge on agricultural land previously used for food production. This need not be detrimental to the health of human kind, but it might restrict the more inefficient food production methods, such as the extravagance of raising certain livestock for human consumption of protein. Relying more on grains and legumes for protein is an odious concept to much of western civilization. Unfortunately for poorer nations, Westerners will be so reluctant to reduce their meat consumption that many more people will have to starve before any sense of altruism or necessity prevails, if ever it does.

Curiously enough, the move to reduce beef production will probably be due more to the excessive methane production in the bellies of cud-chewing animals, than to the fact that three to ten times more feed is needed to raise a kilo of beef than other animal protein such as pork. It is noteworthy that much of the deforestation taking place today, as it has in the past, is to provide grazing land for beef production. This land provision often fails miserably because the death of the forest often means the death of the land. The sacrifices made in the death of the forest then are for nothing, as the would-be farmers and ranchers abandon their impotent and eroded land plots, cleared just a few years before.

X. THE NEED TO SECURE WASTE AIR MANAGEMENT WITH ADEQUATE FUNDING:

Achieving a desirable balance of carbon consuming to carbon emitting processes is the prime objective. It is possible theoretically, that if total carbon dioxide emissions were to be sufficiently reduced, so would the need for some of the restoration systems(forests), as might be the case if carbon fuels were abandoned. The resulting excess in carbon fixing ability could be used to manipulate the atmospheric carbon levels downward, or managers may decide to convert some of the forested land to some other purpose.

Any process which captures or involves carbon dioxide should be considered as a waste management system, or an air recycling system. As the natural components of the planet, its waters and its air, deteriorate under the onslaught of civilization, increasingly more people are learning to regard waste management as an important and integral part of sustaining civilization. But, so far, gas management has only been considered in terms of emission reduction; there has been little mention of air recycling.

Air recycling, the natural process of growing vegetation, has been so taken for granted that the realization of the role of vegetation is not yet commonplace - hence the wanton destruction of the forests. Were these services, that of air exchange, to be rightfully recognized, acknowledged, and

funded, like any other valuable service, concern could be enhanced to an appropriate level. This idea may be foreign to the thoughts of many people who are accustomed to the concept that unlimited quantities of fresh air, like all other natural qualities of the planet, are each person's birthright and natural inheritance. This misconstrued notion of natural birthright must be replaced in the face of defiance, i.e., the continued disappearance of the air replacement systems. Forested nations cannot be expected, while struggling with their own economic hardships, to relinquish without compensation, the economic development of their land in order to maintain existence of air renewing forests for the rest of the polluting world.

Finding the political will to declare forests as valuable air recyclers (or waste management systems, or clean air managers), worthy of substantial funding by the waste air producers, will seem impossible at first. Admittedly, the world is being asked to shift a large portion of its economic base in ways that will cause considerable upheaval, and will be disastrous to those nations which are denuded of vegetation and whose economies have developed using highly polluting industries. An entirely new commodity, with an entirely new "raison d'etre," and additional complications of imperativeness, will be greeted with much skepticism, especially since it will cause a profound shift in the distribution of wealth throughout the world.

Not every society is lacking in political will. There are presently nations which are prepared to commit, or have already committed, substantial funds to combat global warming. They will in the future have to commit still more, but their pronounced determination is a commendable beginning and a powerful example and stimulus. Yet still, these nations can be found wringing their hands in frustration and anxiety because there is no social or market mechanism in place to transfer the funds to where the funds would do the most good.

The concept of paying for the assured continued existence of forests, although not unheard of, is still new and relatively uncharted. Experiments with the idea of funding forestry have generally failed because of fears of lost sovereignty. This fear is the result of feeble attempts by ostentatiously rich nations either to pay meagre compensation, suggestive of swindle, or to buy outright plots of forested land, an obvious infringement on sovereignty. Buying the land is not necessary or even desirable. If compensation for waste air management were sufficient, landlords would be happy to maintain their forests to the exclusion of incompatible land usages. Instead of buying the forests, payment should be for services or renewable leases.

XI. A MARKET SYSTEM TO ACHIEVE ATMOSPHERE RESTORATION:

In fact, the actual service in demand is waste air management, the removal of atmospheric carbon dioxide, and the payment should be exactly for services rendered. In some areas of the globe there are groups of people who are not only responsible for "fouling the yard" but are also prepared to pay for the cleanup, and in other areas of the globe there are groups of

people with the ability to do the job. All that is needed then, is a mechanism to effect the transfer of funds for services ... money for carbon fixing ... and this is starting to have all the sounds of a market commodity.

In speculation, the reason that this market commodity has not come to the fore is because of the unsure demand. With an unsure demand, there is no way to establish a realistic value, and few are about to pay far any cleanup as long as others can continue to pollute at will. If responsibility could be established, polluters could then shop for the services needed to meet their obligations. A method of establishing obligations is needed, as well as a method for distributing the proceeds ... a sort of market or bureau.

As yet, their has been no recognition of the need to create a whole new bureaucracy, especially for the express purposes of dispensing large sums of money by the very same nations which control these worldly affairs. After all, who needs to look for ways to spend more money? The factor not available before, is the recognition of this need; this cleanup need which is mounting in urgency every day - the "Greenhouse Effect".

Now, given the magnitude of the problem, the massive effort required to correct it, and the short time to effect the change, the only solution is one that involves ongoing substantive penalties and rewards for all nations ... a global imperative.

Merely preserving and increasing rain forests alone will solve only half of the problem.

Eliminating industrial carbon emissions will not solve the problem, without preserving the forests.

However, a serious effort to combine these two corrections can solve the global warming problem. In other words, all nations and their ecosystems must be involved if the long term health and survival of civilization is to be assured. All nations should be assessed for their role in the carbon cycle and should be rewarded or penalized accordingly. The penalties should pay the rewards.

In the foreseeable future, all carbon emitting nations would send the funds to tree growing nations as the carbon fixers. Voluntary participation would be ideal but, expectations of such would hardly be realistic. Dissenting or reluctantly participating nations may require forceful impetus, such as international condemnation, or trade sanctions. Any nation which is not part of the solution, will likely be regarded by the others, as part of the problem. The word "coercion" will be bandied about, and will probably be applicable, regrettably, on occasion. Those nations producing pollutants will, by the rest of the world, be demanded to pay their share of the cleanup costs.

An inextricable link tying the need, demand, and value, of carbon removal services to the penalties paid for carbon production, would ensure that the greenhouse problem is being attacked from both its sides. The more need for corrective action, the higher the basic value of waste management services, and the higher the basic penalty fee. The stabilizing forces produced by this link behave as negative feedback; upon the rise of pollution

levels, polluters would have to pay more not only for producing more, but also for the higher penalty rates due to the increased need for corrective action. This progressive fee rate would be the surest way of not only establishing responsibility for polluting on a national basis, but also ensuring that sufficient funds are always available to pay the increased demand and value for the cleanup, and that the cleanup facilities will be encouraged to expand to meet the increased need.

The obvious deviations from an entirely free market driven system are the penalty enforcing regulations. Whereas an ideological confusion may exist with the inclusion of such regulations in a market system, the expectation that all polluters would dutifully and willingly pay-up consistently is naive. It would be like expecting all citizens and corporations to volunteer their fair share of taxes annually, with no prodding from the governments.

Collecting cleanup costs for a common area is impossible without some agreement. The agreement in this case, would be that each nation would agree to pay for its contribution to the problem. All the money would be spent on rectifying the problem, plus administration costs. The basic philosophy is not unlike that supporting the concept of paying taxes to a federal administration which then conducts infrastructure maintenance, or whatever. In this case, all nations are to be taxed according to their damage contribution, and the international organization then applies that money to effecting a cleanup. This agreement having been achieved, will supply a guaranteed demand for services. The market can then be demand-driven; the demand being created by the insistence on the use of carbon fuels.

The price would be allowed to fluctuate, as it would in any demand driven market. The greater the demand for the commodity (carbon fixing), the higher the unit price so as to stimulate an increase in the commodity supply. Should the supply ever approach or overtake the demand, the price shall fall with the drop in demand. The essential functioning of a supply and demand market is maintained. Incorporating the cleanup cost into the cost of the fuel would ensure responsibility. The decision to incorporate this cost would be made at a national level, in any free enterprise system, and this addition would probably become known as a carbon tax. The decision to buy the commodity is then made when deciding to use the fuel, as an inherent cost of the fuel.

Such a marketplace, whose commodity is waste air management or carbon fixing, could provide the mechanism for the transfer of funds from carbon producers to carbon extractors. Due to the international nature of this scheme, buyers and vendours would probably be restricted to national governments and their agents. Another assumption to maintain for ease of discussion, is that the growing of dense vegetation is, for the time being, the only effective means of extracting atmospheric carbon dioxide, and references to forest growing may often mean carbon extraction.

Probably, the most difficult aspect of operating this market, will be in establishing the exact need for the commodity, which will to a large extent, determine the going price. The price depends on the supply shortfall. The supply shortfall shall be that difference between actual existent carbon fixing ability, and the carbon fixing ability that is desired. Determining this degree

of desire, or urgency, is the difficulty. Decision makers will have to balance the advice of scientists seeking ideal environmental conditions at all possible speed, plus commodity suppliers seeking the highest price, against the wishes of carbon emitters seeking to moderate these demands in order to keep the price low. This would be the only condition or action that is abnormal to any other free market, and can be made by a panel of representatives, chosen by whatever criteria seems appropriate, which may include nationality and scientific qualification. In some ways, this decision process would not be very unlike setting fishing quotas, subject to the same fights and corruptions, but a necessary process nevertheless. The effect on the price would also be similar. Should the demand far exceed the supply, prices will soar.

A number of devices are needed to help operate the market. Detailed measurements of carbon dioxide emissions can be made with a variety of methods from audits to satellite recordings. Detailed quantities of carbon fixing abilities would have to be mapped. The difference between the two total figures, heavy on the emission side, will describe the basic total problem, at least in estimate. An annual shortfall of 3 Billion Tonnes of carbon fixing ability could be expected.[1]

The immediate intention of the market then, would be to offer sufficient incentive to ensure the continued existence of the present supply of carbon consuming vegetation, and to stimulate enough new forest growth in order to alter the carbon imbalance. Forests aren't grown overnight, so there will be a lag in new carbon fixing ability which will have to be taken into account, with whatever other pertinent factors, during construction of market influencing formulae. These formulae will be used to establish schedules or quotas. The commodity price will stabilize high or low depending on the likelihood of quotas being met.

When enough time, depending on the sophistication of the measuring devices, has passed to be able to verify the results of tree growers' efforts and their effects, new quotas could be posted, modified to influence the market trend in the desired direction.

As can be expected, the polluting nations will resist and bureaucratic difficulties will arise. Normally, a market is driven by the desirability of the commodity. In this case, the commodity desirability is so subtle and difficult to assess, that it has to be measured and enforced by international consensus. This is the regulatory factor that all other preceding markets have not had to use. The value of other market commodities, such as gold, oil, or strong company shares, has always been easily apparent, which decided its market value through supply and demand. In this case, the desirability has to be determined by a consensus of the signatories and the strength of their conviction to achieve certain atmospheric carbon levels. If the high levels of carbon dioxide seem reluctant to fall, the market value of

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

air recycling will have to climb to stimulate additional forest planting. When new quotas are posted reflecting the urgency, penalties will rise at the same rate as prices, since they are one and the same, to provide the funds to buy the services.

It is possible that as the world moves to a more sustainable fuel, an excess in forested areas or carbon fixing capacity might exist in the face of a reduced demand. It is difficult to imagine such effective pollution control, considering the mounting population and the emerging third world peoples looking for increased technology. Should it happen however, a reduced demand for air purification would be reflected in a reduced market value, and forested nations may choose to begin doing something else with some of their land.

While contemplating the cost of this air cleaning venture, the fact that the value of the forested land must be high enough to be competitive with other potential land usages, may suggest that the total cost to polluting nations will be very high. This is unavoidably true. The services of the forested nations cannot be demanded without fair compensation. While polluting nations may squirm at the prospect of greatly increased overheads, they should remember the two basic reasons for instituting this new expensive program: the atmosphere is in such dire need of renewal because of pollution, and there is no alternative to a healthy atmosphere and no other method of air purification.

In effect, the land will be rented or leased for the purposes of air recycling. In actuality, the land owner will be paid according to the amount of carbon the land is able to fix. If this method seems excessively expensive or land-intensive, the inherent purity of using natural air cleaning, as opposed to artificial methods, should not be forgotten. Even if a mechanical extraction mechanism could be devised, it would require energy and polluting processes for its construction and operation. Trees however, use solar energy in a most efficient and unique way, and in the foreseeable future, it is highly unlikely that this natural method could be bettered; especially in light of the multitude of important side benefits or by-products that a forest provides.

Let us try to imagine some of the possible details of this new market. As mentioned before, all nations would have to be monitored to determine their own carbon imbalance, either plus or minus. This figure might be expressed in terms of Credits or Debits, which would carry a standard mass value of carbon dioxide, say 10 or 100 Kg., something easy to handle. For example, 100Kg. of carbon dioxide is equal to: 1/10 Tonne, the amount breathed out by a 150lb.(68Kg.) person every quarter, the amount produced by an average North American and his/her industrial support every ten days. Canada produces 912.5 million Debits a year (Note; this is a very rough figure, supposed to represent industrial support, and does not include natural sources, nor does it account for any Credits due from Canada's own forests). The worldwide carbon dioxide overproduction is currently said to be 30 billion

Debits annually, or 3 Billion Tonnes.[1] (Should the terms Credit and Debit be found awkward or confusing, any other words could be used, hopefully ones which are easily used and meaningful)

Determining a monetary value will involve at least these few basic considerations: current imbalance, current overproduction rate, and objective. Knowing these would permit an annual quota to be derived, expressed in terms of either excess carbon produced or carbon fixing capability shortfall, which when compared to the world capacity to maintain and grow forests, will establish a market value for a Credit/Debit.

XII. SAMPLE CALCULATIONS TO ILLUSTRATE PRICING PRINCIPLES:

As a rough, hypothetical example, imagine that the carbon dioxide overproduction is 3 Billion Tonnes/year, that the current level is 370ppm, and that the desired level is 310ppm, the same as it was around 1950. Assuming 740 Billion Tonnes of total atmospheric carbon dioxide, the overproduction rate is about .5% each year. Set the target date for 2050. If we could have full carbon reduction immediately (i.e., if we could have ready-made forests right away with no growing time necessary), it would require enough new forests to convert an additional 5 Billion Tonnes of carbon a year, every year. In actuality, the computations would be substantially more complex, having to account for different lag factors, cycles, and other variables. Although this problem as stated is fairly realistic, it is complicated, and with such a high carbon overproduction, an impossible amount of forests would eventually be required. Let us look at a simpler example to get a feel, and return to this one later.

Apparently, the world's total carbon dioxide yearly release is about 6 Billion Tonnes. If the current deforestation were to cease, keeping 1 - 2 Billion Tonnes from entering the atmosphere, and if mankind was to reduce its emissions by 1 - 2 Billion Tonnes, there would be no overproduction, and the gas levels would remain steady. Carbon dioxide producing nations could pay the forested nations an agreeable amount on a constant basis to maintain their carbon fixing ability. Of course, should a polluting nation manage to cut their emissions entirely, there would be no reason for it to pay anything.

Let's imagine that Brazil's lush Amazon basin contributes 20% of the world's carbon fixing capability, and Brazil, as a major player represents and is negotiating for the forested nations; those whose total carbon contribution is on the credit side. Brazil decides that no more of its forests will be burned, and the Amazon region can continue to process the 600 Million Tonnes of carbon dioxide yearly for $10 a Tonne; equivalent to $1 a Credit, and a

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[1]Stephen H. Schneider. "The Changing Climate," *Scientific American.* (September 1989), 70.

total fee of $6 Billion a year. These figures are found to be acceptable to the other nations, perhaps after much haggling, and the going price for a Credit/Debit; the emission of, or the removal of 100Kg of carbon dioxide to or from the atmosphere, is established at $1.

Let's assume that Canada's 25 million inhabitants release 4 Tonnes each, every year, totalling 100 Million Tonnes. Let's say that the value of Canada's forests, being too far north to be very effective carbon grabbers, is 1% of the world's total carbon fixing ability, and provides recycling of 30 Million Tonnes. Canada's total responsibility, emissions minus fixings, is 70 Million Tonnes, or 700 million Debits at $1 each.

Looking at the USA, with 250 million inhabitants at 4 Tonnes each, and .5% (Hypothetical case, remember) of the world's forests, the total commitment would be (amount emitted minus amount fixed) 985 Million Tonnes, or 9.85 Billion Debits at $1 each.

Any nation that had forests with a carbon fixing ability to match its emissions, would be attributed neither Credits, nor Debits, and wouldn't be affected by the scheme at this time.

An international organization could handle both the technological (measurements) and the legal affairs, and act as a marketplace, a place of business, and bank; perhaps the World Bank. It would monitor emissions and forestation, and issue Credits and Debits appropriately. Appeals could be brought before this organization, to settle disputes, probably over measurement differences. The concept of a World Atmosphere Fund is not new, but this method of attributing responsibility and generating funds is.

The bank could collect all Debit payments (in reality, polluting fees), through installments or whatever, and dole out the Credit payments (in reality, waste-handling fees). Loans could be arranged in the form of advanced or deferred payments.

Taking the experiences discussed in the last few paragraphs, let us address the original example of trying to reduce the carbon dioxide concentration to 310 ppm by the year 2050. Assume that deforestation, in light of the new investment value, has stopped , and through energy conservation, total emissions have dropped by 2 Billion Tonnes, and gas levels have stabilized. Scientists however, warn that droughts are worsening, or for whatever reason, and that the 310 ppm must absolutely be pursued.

Achieving 310 ppm in sixty years, will require an average yearly reduction of .5% of total atmospheric carbon, or about 3 Billion Tonnes, equivalent to 30 billion Credits. The scheduling of the target, or the desired rate of change, will determine the demand on the credit (100Kg of carbon dioxide). The reaction of tree growers, and how readily they commit to fill the demand, will in turn influence the price for their service.

The previous rate of $1 a Credit was only enough to buy waste management for 30 billion Credits. To meet the new demand to process 60 billion Credits a year, will require much more land to be devoted to forests, and a higher incentive will be needed to coax the land from other occupancies.

Also, $1 a Debit penalty (recycling costs) was able to influence emission restrictions only to a certain degree, the remaining pollution and cleanup costs having been found acceptable to consumers. Raising the value of a Debit would act as stronger incentive to further reduce emissions. The effect of the higher value of the Debit then is two fold: pressure is exerted to reduce emissions, and incentive is provided to boost forest growing. The difference between paying these fees and paying a traditional tax, is that all of the funds, minus administration costs, are directed entirely toward minimizing the need for the fees. It is important to maintain the direct relevancy between the fee, and the emissions, and the correctional service, for this whole program to maintain purpose and direction, and for it to be found acceptable to all players.

In order to reduce the total atmospheric carbon dioxide, or its concentration, the amount of carbon being fixed will have to surpass the amount being emitted. Peoples who don't pollute, should never be charged (they often have no means to pay, anyway). Following the principle that only polluters should pay, since they are financing their operations by polluting, establishes responsibility for payment to overbalance the carbon fixing capacity. A shift in calculations will be required to reflect this new emphasis. Whereas the previous method of calculating responsibility by assessing each nation's ability to balance their emissions with their fixings, this worked well only to halt the rise in gas levels by equalizing emissions to corrections. To actually reduce the level, new formulae may have to ignore each nation's ability to fix, and new modified Debits, based only on emissions, could establish the responsibility for further carbon level reductions.

For example, let's pretend that Canada produces 2% of the world's emissions, but has forests enough to cancel the emissions. If the concentration of carbon dioxide was at a satisfactory level, there would be no fees, no Debits. However, should it be deemed necessary to reduce gas levels, not just to maintain them at a static point, by increasing forests and carbon fixing by an additional 30 billion Credits, Canada's new commitment would be 2% (emissions without correction) of the 30 billion Credits excess needed for gas level reduction - 600 million Debits, which is added to their previous account, calculated with forest correction, of zero.

Canadians might, in this instance, protest the purposeful disregard for their valiant efforts at maintaining sufficient forests to counter their carbon emissions. During this time, every other nation is undergoing the same reevaluation which ignores their carbon fixing factors, and this modification is then added to the basic calculation which did include corrective factors. If the emissions did not exist in the first place, there would be no need for restorative actions, or even for this whole scheme.

Let's imagine that Brazil, which has been fixing 1/5 of the world's carbon dioxide, and has been collecting nearly 6 billion Credits annually, also produces 2% of the world's total emissions. Although their level of industrialization and their heating costs are much lower than that of Canadians, their higher population produces much the same emission level as that of Canada (hypothetical). Brazil's previous credit was 6 billion minus 600 million, or 5.4 billion Credits. The new Credit total would now be 5.4 billion minus another 600 million (their 2% of carbon contributions), to equal 4.8

billion Credits. As with Canada, all carbon producers would have to pay an increased amount to increase the value of the credit which assures increased forestation funds, in order to overbalance carbon emissions and produce an actual reduction in existing carbon dioxide levels.

XIII. ADDITIONAL MARKET FUNCTIONING DETAILS:

The same effect could be achieved by applying a factor, in this case a factor of 2, to the value of a Debit, while leaving the value of a Credit at normal value. The perception of the complexity of these modifications would rely on effective wording. A number of methods could be used to stimulate a demand change and price change. Besides applying factors to Debits, which alters the commodity demand, the quotas can be adjusted following whatever criteria seems appropriate, which would alter the price. (It will seem unfortunate to free-business thinkers, that the market should be tampered with, artificially and for destabilizing purposes, but the reason goes back to the fact that the subtle but urgent demands of nature needed to be recognized and legislated. This was the original reason for instituting this program.) For instance, natural growing cycles will demand that quotas are scheduled accordingly and responsibly, or the market will fluctuate too erratically to effectively regulate the program, and debts and payments would be impossible to budget.

Establishing these quotas (yearly targets) will have the strongest influence on the setting of the value or price of a Debit/Credit, and so, will have to be done very carefully. Scientists, statisticians, and economists will have to consider such things as: actual conditions, plan-of-action or agenda, modified by realistic appraisals of the world's ability to respond, etc.. The function of setting a quota is not just to provide a researched guideline, but also to influence the market value so that investments are properly directed as a corrective force.

Changing atmospheric gas levels is not a speedy event so there would probably no need to set new quotas more often than semiannually or quarterly. The commodity value would be free to float and assume its own levels, according to the influence of supply and demand. It would be good at this point to remember again that this whole venture wouldn't have started without the understanding that it was absolutely necessary, and that the polluting nations agreed to support the program, at whatever price was required.

Since funding is guaranteed for the published quota, the floating value will reflect the tree growers' tendency to meet that quota. If with one quota setting the going price of a Credit was too low to secure enough carbon fixing, the price will climb until more forests are committed. As fulfilment of the quota with the end of the guaranteed funds approaches, the price will fall with the declining urgency in demand. Forest growers who delay announcing their commitments in order to drive up prices, will run the risk of being displaced by more eager growers. There would be many, many details to be resolved, probably on a continual basis, as new situations and realizations

arise. For example, if a quota system experiences an over-quota growth of forest, how will the surplus grower get paid? After all, that surplus growth is worth something and will also serve to lower subsequent quotas. Perhaps the value of surplus commodity should be reduced, or full value could be awarded but withheld until the posting of new credits, or whenever a new market cycle is commenced.

It is difficult, without experience, to envision the timing of all these events. The decisions effecting the quotas and prices will involve complex considerations, factual and speculative. For instance, since the growing of trees is fundamental to the program, some primary cycles will be lengthy; these restorative growths won't be fully available until years after their planting. This type of lag, if improperly anticipated, could cause erratic market behaviour, especially if compounded by other unanticipated cycles, and could result in the development of an extreme condition. Unrealistic expectations of growth speed could, for instance, result in a far higher carbon dioxide level than intended; a condition which, as described earlier, could become intolerable.

Initially, there will be an explosion of research and discovery. The coordinating bureau, market-operators, or bank, will develop methods to measure both carbon dioxide effluent and intake, probably using a myriad of new films, cameras, recording devices, and computer programs. Private and government agencies will parallel some of these efforts, and some will work hard to develop vegetation with the highest rate of carbon exchange. With so much money involved, there surely will evolve a cadre of dealers, lawyers, and brokers who will plead the cases of their clients, mount appeals, arrange for credit (loans), and generally involve themselves in this flow of wealth.

Representatives of paying nations will be arguing their cases and ensuring that they are being charged no more than necessary. The charges will be high enough that fuel conservation efforts will become valuable. Research into "sustainable" fuels will be immediately intensified, and will become a national objective throughout the world. Some nations will be hopelessly swamped in debt and will need assistance. These will be nations which have polluted their land and waters, and whose industry has developed with no regard for emissions, amongst which will be found E. Germany, Rumania, Czechoslovakia, etc..

As suggested before, the cost to fund this program will be staggering and relentless for many years. The greatest relief will arrive with the adoption of a more sustainable fuel; probably solar-generated electricity and hydrogen. Fusion may yet rise to prominence, but there may develop serious resource shortages during the research, development, and even manufacturing of the reactors. If this adoption takes too long however, the gas levels will be too high to easily reduce, and the program will have to continue for a distressing period of time. It is expected that even after the adoption of a clean fuel, there will still be a substantial carbon emission, depending on population levels for example, and there will still be a need to guarantee the continued existence of sufficient forests, albeit at a reduced quantity.

Actually, the continued need for extensive forestation might remain high, as is suggested by considering some important generalities. Data is scarce, to allow extrapolation, but there surely is a finite amount of carbon that can be processed in a given period of time, once a forest has grown to full maturity. If the claim that soil in temperate growing zones has been demineralized is true, re-mineralizing the soil with pulverized rock might enhance the growth capacity substantially. However, with only a finite amount of arable land to share with agriculture and other occupancies throughout the world, the competition for land occupancy could become fierce. With so much of the previously underground fossilized carbon that will have entered the atmosphere, the ability to process it all back to the ground in the form of vegetable material is not a surety. Long term greenhouse gas levels may have to remain higher than is ideal.

XIV. PROFOUND SIDE EFFECTS TO REFORESTATION:

While the implications of this proposal are being pondered, it should be noted that a secondary effect of profound proportions will occur; the flow of wealth from south (tropics) to north (industrialized or developed) will to a large degree, be reversed. Of course, this won't be happily greeted by short-sighted opportunists who have relied on the exploitation of the third world, but it will be heralded by anthropologists. They have been warning the world of pending disaster due to a backlash from the intensifying human tragedy in the poorer nations, not to mention the fact that it is morally repugnant to allow the tragedy to continue. An opportunity to climb out of debt, in a dignified fashion, will be presented to those nations which can grow trees. This offers little hope for now to nations which cannot grow forests, like the Sudan, although they may benefit indirectly through improved rainfall patterns, but at least these nations tend not to be high carbon producers, and their debt will not be increased by the program.

There are yet other side effects of enormous importance and advantage to implementing this program: forests provide unparalleled refuge for a far greater number and variety of organisms than any other terrestrial environment, forests increase the exchange of water between earth and sky, and forests are the best protection from soil runoff. Also, acid rain resulting from the release of sulfur, that always accompanies the presence of carbon as an essential component of organic structures, will be reduced along with the carbon dioxide, as the burning of forests ceases, and the use of more sustainable fuels is adopted. The most serious emissions of carbon monoxide and methane will be eliminated with the cessation of forest burning. This will all happen as a matter of course, without any added effort or need for additional legislation.

Eventually, other methods of carbon exchange, or air recycling, may be discovered or devised. Perhaps efforts at rejuvenating or enhancing some marine functions might be rewarded, which would be a great relief in view of the improbability of a complete atmospheric restoration through forests alone.

To a great extent, we have to learn as we go ... but, we are going so fast, there is little time for corrections. If we had centuries in which to study all the intricacies and implications of environmental impact, we would be able to adjust formulae, refine techniques, and tweak performance factors, to better predict the future. The timetable however, has been foreshortened by a burgeoning population, hungry for technology and the "good life", and unaware of the incredible burden this places on our planet whose recuperative abilities are limited by natural physical factors.

Scientists have been wrong before, and with the whole problem of global warming being so very difficult to accurately assess, there is the possibility that there will be miscalculations on the effectiveness of forestation. But, compared to other major projects attempted by man, this one is benign in nature. In fact, the beneficial side effects alone are, considered by many people, enough to justify preserving and growing old and new forests. The only possible detriment is that some people will deem the program too hard on some economies, forgetting that those polluting economies have been robbing the rest of the world the whole time, and that those economies are, to a large extent, the reason for the necessity to implement a program like this one in the first place, and they are forgetting or ignoring the opportunities being offered to the third world. Compare these side effects to the hazards presented by other major efforts like the erecting of a large dam, or the development of nuclear power with its indissoluble dangerous waste, or the clearing of a continent for rangeland.

The real danger is that we do nothing. Even with miscalculations, the monetary cost to some societies may be high in adopting this program, but the overall costs will never be too high; i.e., it cannot harm the planet.

THE FOLLOWING IS A LIST OF THE RECIPIENTS OF THE 3rd EDITION PROPOSAL, WITH THE DATES AND POSTAGE COSTS. THOSE WITH NO POSTAGE COSTS WERE EITHER HANDED PERSONALLY OR WERE SENT TO THE HOUSE OF COMMONS. * DENOTES RESPONSE OR ACKNOWLEDGEMENT RECEIVED BY AUG. 9, 1990.

New Yorker Magazine	May	10	1.17	*
Dr. Ross, U of Calgary		10	1.17	*
Dr. Middleton, U of Guelph		10	1.17	*
Dr. Hube, U of Alberta		10	1.17	
F. Oberle, Ministry of Forestry		10		*
Eckhart Stoyke, School Board Energy Consultant		10		*
Gordon Begg, private citizen	May	11		*
Canadian Environmental Law Association, Toronto		11	1.17	
Rob Macintosh, researcher, Pembina Institute		11	1.17	*
Environmental Law Center, Edmonton		11	1.17	*
Lucien Bouchard, Minister of Environment		11		*
Standing Committee on Environment, Ottawa		11		*
Kai Millyard, Friends of the Earth, Ottawa		11	1.17	
Canadian Environmental Network, Ottawa		11	1.17	
Stephen Lewis, Diplomat		11	1.17	*
Dr. D Suzuki, Toronto CBC		11	1.17	*
North/South Institute, Ottawa		11	1.17	*
Elizabeth May, Cultural Survival(Canada) Ottawa		11	1.17	*
Peter Newmann, CIL executive, St. Bruno		11	1.17	
Manuel Guerra, influential activist, Mexico		11	1.17	
External Affairs Canada, de Hoog		11	1.17	*
The WILD Project, Vancouver		11	1.17	
Alberta Federation of Labour, Lucien Royer	May	12	1.17	
Doug Jenkins, private citizen		12	1.17	*
Dave de Volpi, Private citizen		12	1.17	
Lyle Elder, private citizen		12	1.17	
Bruce Dobbie, private citizen		12	1.17	
Greenpeace, Toronto		12	1.17	
Pollution Probe, Toronto		12	1.17	
Canadian Coalition on Acid Rain, Toronto		12	1.17	
Energy Probe, Toronto		12	1.17	
Jerry Mander, Calif. author of some influence		12	1.90	*
West Coast Environmental Ass. Vancouver		12	1.17	
Earth Island Institute, San Francisco		12	1.90	
IFSDS, San Francisco		12	1.90	
COICA, New Orleans		12	1.90	*
Watchfire Productions, California		12	1.90	
Stewards of the Earth, Goleta, California		12	1.90	
Green Committee of Correspondence, Kansas City		12	1.90	
Climate Protection Institute, Oakland		12	1.90	
The New Brunswick Environment and Development Group		12	1.17	
Rainforest Health Alliance, San Francisco		12	1.90	
Roy Begg, Vancouver businessman		13		
David Kerslake, Alberta businessman		15		

Duane Pendergast, Atomic Energy Canada and Sheraton Park Research Community	May	22	1.17	*
United Nations Environment Programme, New York	May	23	1.90	
Maurice Strong, Secretary-General, UN Conference on the Environment, Switzerland		23	4.20	*
Finland, Ministry of Environment, Helsinki		24	4.20	
Norway, Department of Environment, Oslo		24	4.20	*
Noel McNaughton, CBC columnist		24		*
Brazil, Environment Minister via Embassy		24	1.17	
Brazil, Environment Minister, Brasilia		24	4.20	
World Bank, International Bank for Reconstruction and Development, Washington DC		24	1.90	*
J. Epp, Minister, Energy, Mines and Resources	May	25		*
Prof. T. Veemen, Economics, U of Alberta		25	1.17	
Sweden, Ministry of Environment, Stockholm	May	28	4.20	
Sweden, Ministry of Agriculture (Board of Forestry), Jonkoping		28	4.20	
Allan Sugg, researcher, Swedish U. of Agricultural Sciences, Umea		28	4.20	
Netherlands, Ministry of Environment, the Hague		28	4.20	
Jim Fulton, NDP Environment Critic, Ottawa	May	31		
Pierre Garsonnin, businessman, France	June	6	8.35	*
R. Semeniuk, lawyer, Vegreville, AB		6	1.17	
Dave Hill, Crown Attorney, Edmonton		6		
Ministerio de Recursos Naturalist, Costa Rica		6	4.20	
International Environment Affairs, publication		6	1.90	*
Alternatives, U. of Waterloo, publication		6	1.17	*
T. Corcoran, Economist, Globe & Mail		7	1.17	
Canadian Climate Centre, Downsview, ON		11	1.17	
University of New Hampshire, Dr. Barrett N. Rock		11	1.90	
Madison Center for Human Systems, Prof.Marty Kanarek		12	1.90	
Oregon State University, Climatic Research Institute		12	1.90	
International Center for the Solution of Environmental Problems, Houston		12	1.90	
University of Manitoba, Dr. Henson		12	1.17	*
Ecology Action Centre, Halifax, Susan Holtz		13	1.17	
Institute for Environmental Studies, University of Toronto, Pamela Stokes		13	1.17	*
Canadian Institute for Research in Atmospheric Chemistry, York University		13	1.17	
Systems Ecology Research Group, San Diego State U.		13	1.90	
Renew America, Tina Hobson, Washington, DC		13	1.90	
Clean Energy Research Institute, Miami University		13	1.90	*
Global Foundation, Inc., Coral Gables, Florida		13	1.90	
Environmental Defense Fund (EDF) New York		13	1.90	*
Marine Carbon Research, Sidney, BC		13	1.90	
Dr. G. Rostoker, Physics Dept., U. of A.	June	20		*
Irwin Kilotat, Environment Canada	Aug.	3		

MINISTRY OF ENVIRONMENT

OFFICE: MYNTGATA 2, OSLO. TELEPHONE NO. 47.2. 34 90 90
TELEX NO. 21480 env n - TELEFAX NO. 47.2. 349560
POSTAL ADDRESS: P.O. BOX 8013 DEP., N-0030 OSLO 1, NORWAY

Mr. Daniel Garsonnin
6 Arkinsdale Gardens
St. Albert, Alberta
CANADA T8N 2W5

90/3267-2 LI PRK/AK
Ark. 008.2

13 JULI 1990

Dear Mr. D. Garsonnin,

Thank you for your report "A Proposal to Combat Global Warming". As a personal initiative this is a very impressive and comprehensive document. It is quite obvious that you have studied the problem of global warming carefully.

I will not give a detailed comment on the report. However, your suggestion for a solution has semblance to an international tax on carbon emission where the tax on carbon to sinks is negative.

We are facing large economical, political and technological problems in fighting global warming. In the process of reaching an international agreement all proposals on a solution are welcome, and so is yours.

Yours sincerely

Petter R. Koren

Petter R. Koren
Head of Division

The World Bank
INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

1818 H Street, N.W.
Washington, D.C. 20433
U.S.A.

(202) 477-1234
Cable Address: INTBAFRAD
Cable Address: INDEVAS

June 18, 1990

Mr. Daniel Garsonnin
6 Akinsdale Gardens
St. Albert, Alberta
Canada T8N 2W9

Dear Mr. Garsonnin:

Thank you for your letter of May 24, 1990 and attached paper, which has been passed on to me.

We will review your interesting proposals in relation to our own environmental and forestry work, and get in touch with you in due course.

With kind regards.

Yours sincerely,

Mohan Munasinghe
Chief, Environmental Policy Division

United Nations Conference on Environment and Development
Conference des Nations Unies sur l'Environnement et le Développement

Tel. Intl. +41-22-789-1676
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P.O. Box 80
CH-1231 Conches
SWITZERLAND

20 June 1990

Mr. Daniel Garsonnin
6 Akinsdale Gardens
St. Albert, Alberta
Canada
T8N 2W9

Dear Mr. Garsonnin:

Thank you kindly for your letter of May 23, 1990 and the enclosed material. I found it to be a very interesting proposal and certainly germane to some of the issues with which I am dealing.

Once again, thank you for taking the initiative to contact me. Best regards.

Yours sincerely,

Maurice Strong
Secretary General
UNCED

MFS/ds

UNIVERSITY OF Miami

26 June 1990

Mr. Daniel Garsonnin
6 Akinsdale Gardens
St. Albert, Alterta
Canada T8N 2W9

Dear Mr. Garsonnin:

Thank you very much for your letter of 13 June 1990 enclosing your proposal for the remediation of the greenhouse effect. It sounds convincing; at least it will solve some of the problem if not all of it.

In order to give publicity to your idea, I suggest that you convert it to a paper which should included an abstract and references, as well as the idea which would form the basis of the manuscript. In such a case, we will consider it for the new International Journal of Energy Environment Economics, which will have its first issue out in January 1991. Please find enclosed a paper guidelines for your use.

Wishing you the best in your endeavors, I remain

Sincerely yours,

T. Nejat Veziroglu
Professor & Director

TNV:dgp

Enclosure

Clean Energy Research Institute
College of Engineering
P.O. Box 248294
Coral Gables, Florida 33124
(305) 284-4666

- as an addendum to RESEARCH PROCEDURE:

During the search for criticism and viability, nearly 100 copies of the last edition of the policy proposal were mailed or handed out. A partial list of recipients has been supplied as an indication of the level of activity following the issuing of a new edition. Almost all of the responses have been encouraging and congratulatory. Copies of a few of the simpler letters have been attached, and quotations from others are provided below:

"Thank you for your report "A Proposal to Combat Global Warming". As a personal initiative this is a very impressive and comprehensive document. It is quite obvious that you have studied the problem of global warming carefully."

"We are facing large economical, political and technological problems in fighting global warming. In the process of reaching an international agreement all proposals on a solution are welcome, and so is yours."
(July 13, 1990. Peter R. Koren, Head of Division, Ministry of Environment, Oslo, Norway.)

"A very thorough, thoughtful and thought-provoking discussion."
(Dr. Doug Hube, Prof. Earth and Planetary Sciences, U. of A.)

"The idea is interesting and your writing style is good for conveying the message to an audience which is educated but lacks the factual background to understand and put the environmental issues of today into a broad perspective so as to formulate effective solutions to the problems."

"Given your commitment to this idea, I would encourage you to try to develop it further."
(May 22, 1990. Howard Somoil, Environmental Law Centre, Edmonton.)

".... if your document is to have any impact it is essential that you get it to the correct people. Is it possible that you can find a powerful ally? For example, can you get the ear of parliamentary environment critics? You need to find someone who knows the system and who can give you guidance on the steps you need to follow in bringing good ideas to political reality. Many good ideas have disappeared simply because they were not carried forward through the proper channels. At this stage it might be worth your while to enlist the support of groups that already have a high profile and public credibility eg. World Wildlife Fund and its program for forest conservation. They, too, could help in giving you advice."

"Finally, I hope you will not be discouraged. Realize that you will encounter

many obstacles, and that you will have to be persistent. Be prepared to compromise on the ideal, to achieve at least, a workable plan that is moving in the right direction. Finally, take the time to polish your ideas and your document."

"We need individuals such as you to continue to carry the fight. Best wishes with your endeavour. It deserves serious consideration."
(April 19, 1990. Alex Middleton, Ass. Prof., U. of Guelph)

"Your knowledge of the issues is, indeed, impressive, and I greatly appreciate your taking the time to bring your ideas to my attention. They will be kept in mind during the preparation of Canada's Environmental Agenda."
(Lucien Bouchard, Minister of the Environment)

"I have passed your report to several of my colleagues who may choose to comment on it directly to you. I encourage you to continue your study of this very important issue and to carry on with the all-important task of informing people of the nature of the climate change threat and the types of steps they can take to alleviate this problem"
(A.C. de Hoog, Director, Energy and Environment Division, External Affairs and International Trade Canada.)

".... I have asked my officials to review the enclosed "Proposal to Combat Global Warming." It is indeed an ambitious proposal; you have obviously given much thought to the subject."
(Frank Oberle, Minister of Forestry, Canada)

"Thank you for your letter of May 11, and for the paper elaborating your proposal to combat global warming. Maureen O'Neil has passed your paper on to me, and I found it extremely interesting."

"You explain very well, for a non-expert like myself, the dimensions of the problem."

"Maureen O'Neil has suggested that we pass your latest paper on to David Runnalls at the Institute for Research in Public Policy, 275 Slater Street (fifth floor), Ottawa. He is deeply involved in parallel work to yours, and is working in particular for the 1992 Conference on Environment and Development. You may well be in touch with him already, but in case you are not, we will send him it."

"Thank you again for writing."
(Clyde Sanger, Director of Communications, North-South Institute, Ottawa)

"Thank you for your letter and attachment of June !2. May I say with respect that I think it admirable that you have taken the initiative of preparing this proposal. There is a good deal of thought-provoking material in what you have to say."

"May I say again that I was very interested in your idea and hope that you will pursue it to the point of refinement perhaps in the directions I suggest."
(June 22, 1990. Dr. W. R. Henson, Director, Natural Resources Institute, U. of Manitoba)

"Thank you for your long and thoughtful response to my modest suggestions. It is perfectly clear from your letter of July 12 that you understood my points and I look forward to seeing your future redraft."
(July 19, 1990. Dr. W. R. Henson, Director, Natural Resources Institute, U. of Manitoba)

"You have taken a very rational and measured approach in assessing the problem and in recommending a game plan to deal with the envisioned future."

"I hope these thoughts give you some extra ideas which might be helpful as you pursue your goals."
(Dr. Gordon Rostoker, Director, Earth and Planetary Sciences, Physics Professor and Department head at U. of A.)

"Good luck with your work, I appreciate sharing your thoughts with us. Please send along any further iterations of the proposal, although I can't promise a rapid turn-around"
(Rob Macintosh, Executive Director, Pembina Institute For Appropriate Development, Drayton Valley)

Daniel Garsonnin Aug. 9, 1990

NORTH-SOUTH INSTITUTE / L'INSTITUT NORD-SUD
55 Murray, Suite 200, Ottawa, Canada K1N 5M3 (613) 236-3535 Telex 053-3300

June 11, 1990

Mr. Daniel Garsonnin
6 Akinsdale Gardens
St Albert, Alberta
T8N 2W9

Dear Mr. Garsonnin:

Thank you for your letter of May 11, and for the paper elaborating your proposal to combat global warming. Maureen O'Neil passed your paper on to me, and I found it extremely interesting.

You explain very well, for a non-expert like myself, the dimensions of the problem. My single comment would be that your scheme for pollution fees stands (or falls) by having an effective fee (or tax) collection organization. I did not see, on page 18, much attention to this point.

I gather that the Commons Standing Committee on the Environment, under David MacDonald MP, has been studying global warming as a priority subject and is likely to produce its report in the next month or so. Greg Wirick, of the Parliamentary Centre here in Ottawa, has been the researcher/scribe of the committee. I don't know whether you have been involved in any way with the work of this committee, but I give you these names, anyway.

Maureen O'Neil has suggested that we pass your latest paper on to David Runnalls at the Institute for Research in Public Policy, 275 Slater Street (fifth floor), Ottawa. He is deeply involved in parallel work to yours, and is working in particular for the 1992 Conference on Environment and Development. You may well be in touch with him already, but just in case you are not, we will send him it.

Thank you again for writing,

Yours sincerely,

Clyde Sanger
Director of Communications

ENVIRONMENTAL DEFENSE FUND

257 Park Avenue South
New York, NY 10010
(212) 505-2100

Frederic D. Krupp
Executive Director

July 23, 1990

Mr. Daniel Garsonnin
6 Akinsdale Gardens
St. Albert, Alberta Canada T8N 2W9

Dear Mr. Garsonnin:

Thank you for your letter to EDF's Executive Director, Fred Krupp. I am very sorry for the delay in our response, but because we receive such a large volume of mail and because Mr. Krupp's schedule often takes him away from the office for long periods of time, we sometimes get behind. Mr. Krupp is currently out of the office again for several weeks, therefore I am writing to avoid further delay.

Thank you for sharing your proposal on global warming with us. I will forward it to the staff people working on this important issue for their consideration. If they have comments or recommendations for you, they will be in touch.

Yours truly,

Diana Widener

Diana Widener
Executive Assistant to
Fred Krupp

/dkw
cc: Rod Fujita

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CLEAN AIR STRATEGY FOR ALBERTA

Prepared for;

ALBERTA ENERGY
and
ALBERTA ENVIRONMENT

Prepared by:

EUGENE GAWOR, M.Sc.,P.Eng.
Representative of:
E.E.E. Services
8 Woodford Close S.W.
Calgary, Alberta
T2W 6E1

December 05,1990

December 05,1990

CLEAN AIR STRATEGY FOR ALBERTA PRESENTATION

Mr. Chairman,Members of the Committee
Ladies and Gentlemen

It is a real pleasure for me to be with you this evening in order to share our common concern, which is our care about clean air.
We all want to breathe clean air.

1. Introduction, general remarks.

Are we really serious about clean air for ourselves, our children and future generations?

Don't wait, use new and modern technology, implement new strategy into Clean Air Act and Environmental Protection Act.

Ladies and Gentlemen;
It is fortunate that these days there is more appreciation and understanding for environment, clean air,improved energy efficiency and energy conservation.

Motto: There is no cheaper barrel of oil or unit of energy from energy we conserve.

Therefore improved energy efficiency has to be the driving force in abating air pollution, in helping clean air, in helping our environment.
It is hard for specialists of energy conservation and environment to agree with some politicians who think that pollution is cheap and clean air and environment expensive. Further, polititians believe that the only way to reduce power plants emissions is to raise consumers electricity bills to pay for scrubbers installed on smoke stacks.

I am going to give you some numbers in order to substantiate the above wrong conclusion.
In 1988 USA industry polluted own country and neighbours, as follows: 20.7 mln ton of SOx
19.8 mln ton of NOx.

(.....continued)

According to new 1990 Clean Air Act, USA is going to reduce emissions as follows:
SOx by 10 mln ton/year
NOx by 3 mln ton/year

USA Government is planning to spend 19 billion dollars to help environment.
Some members of the Congress are crying already that after implementing new Environmental Protection Act the costs will go up to (80 - 100) billion of dollars.

The other side of the coin is as follows:
Health costs only of doing nothing to clean the air cost USA Government over 100 billion/year. Here we should also know that more money is wasted on inefficiently used energy than on entire military budget of 10,000 dollars/second.
It means that more than 315 billion of dollare is wasted each year, despite that energy efficiency was improved since 1974 by giving USA Government savings of 150 billion dollars/year and at the same time the rate of SOx, NOx and CO2 emission was substantially reduced.

Another example of potential savings using today`s technology by improving energy efficiency which is leading to reduction of air pollution.
We can save about 75% of all electricity in Canada by using today`s technology and apply properly to residential, commercial and industrial facilities.
25% saving can be accomplished in lights, 25% in motors and 25% in the rest.
We can save about 75% of the electricity by replacing incandescent lights by fluorescent, e.g 18 watt fluorescent lamp provides the same light what 75 watt incandescent lamp. They don`t only save power but also last 13 times as long as an ordinary bulb.
We save also on maintenance by replacing lights, therefore the total cost is less than zero.
We can use also mirrors, reflectors to improve lighting.

We can save (8000 - 9000)MW in lighting only by using today`s most efficient technology, which is more than Alberta total power installed.

Unfortunately in some industries electric intensity is rising while in Japan and Western Europe is falling, e.g. steel, cement, pulp and paper.

(....continued)

Since 1974 (the first oil crisis) Western Europe and Japan have cut their dependence on oil in half, while USA and Canada's dependence has gone up.
Those countries were keeping gas prices high through taxes, because they were smart to realize that improved efficiency and energy conservation was important in 1974 and is important now.
Presently we at North America are hostages to Middle East oil and will be for years to come until we realize that any nation that is not energy independent is not independent.

I strongly believe and will pray to God for politicians to have a vision of clean, efficient and productive Canada we all dream of , that new issues of Canadian Environmental Protection Act and Clean Air Act will include improved energy efficiency as a major driving force to reduce substantially atmosphere pollution to reduce potentially global warming disaster envisioned by scientists.

2. The barriers to energy efficiency improvement.

a. Lack of information and awareness.
b. Wrong attitude.
Most of the senior management still believe that they are in business of selling kWHr of electricity and want to sell more. Customers however want less electricity and more efficiency. Utilities including Ontario Hydro still pay only up to 10% to save energy and over 90% to make. This is a major mistake in misallocating capital.
c. Lack of specialized services.
Government doesn't have offices with clear responsibility for designing and implementing energy efficiency. There isn't any legislative or regulatory act which would clear address energy efficiency.
Enterprizes also don't have in their organizational structure real energy management offices to look after company energy efficiency performance and potential savings.
d. Technical Know-How.
Technical Know-How is inadequate within government and enterprizes to the need of designing and implementing energy conservation demands and appropriate budgets.
e. Profit
Utility companies make more profit by selling more electricity.
f. Pay - back gap.
If we invest in saving energy we want return in (2-3) years. If we don't invest Utilities must build a new Power Station and get money back in (20-25) years. We shouldn't compare 2 year pay-back with 25 years.

(.....continued)

3. Recommendations in a quest for Clean Air Act strategy in Alberta.

a. Educational and promotional programs.

b. Review and revise the list of advisory group members for clean air strategy for Alberta.
- list shouldn't include representatives who will be in conflict with their own company policy, if they are real promoters of clean air/energy efficiency.
- list should include only liberal and positive promoters.

c. Include members/promoters of increased energy efficiency and conservation in Alberta.

d. Promotion of engineering ethics, attitude and achievements in the area of environment and increased efficiency and energy conservation.
Formerly engineers were heroes of modernization, now have become villains in an age of environmental concern.

e. Revise royalty charges and taxes.
Royalty charges should be reviewed. Presently province is charging royalty for a gas which is sent to pipeline and no charges on gas flared (wasted).

f. Pollution prevention strategy.
Strategic shift from control and clean-up to prevention of pollution is essential to the environment and healthy economy. Energy efficiency is the best and cheapest way to clean the air.

g. Least cost approach to control emission.
The cheapest approach to control emission is to increase efficiency by installing efficient lights, motors, appliances etc.

h. Promote national and international importance of energy conservation.

i. Review and reexamine subsidy programs for energy producers by considering the importance of energy efficiency.
Billions of dollars are spent by both levels of Government subsidizing megaprojects and not checking the potential of increased efficiency and energy conservation, the performance of the company.

j. Research and development programs in searching for new and improving existing technologies.
This is the only way to be competitive in the world today, otherwise we as leaders in oil and gas production today will be buying new technology from our students.

(....continued)

k.Tax breaks on environmentally friendly products which have to be approved by specialized government agencies.

l. Energy efficiency audits, technical assistance and training programs.
All these programs shall be sponsored by the Ministry of Environment in order to monitor the performance of industry in the province. These audits would monitor how much electricity is consumed per ton of physical output. On the other side the same audit would show the pollution of air, water and soil.
Such audits would enable Government to know the performance of the company in the comparison to others and the local and international standards.

m.Profits of the Utility Company shouldn't be a function of supply but a function of demand with least costs combining capital costs and operational costs.
There are some companies abroad that make profit based on saving energy for customers.

n.The decision to allocate capital/investment should be made by properly and very thoroughly calculating least pay-back time, not only on energy supply but on demand as well.

o.Energy future, energy production and energy development should include environmental concerns e.g. pollution costs etc.

p.Foreign aid for developing countries should take into account very modern technology and efficient equipment.

December 12,1990

Clean Air Strategy for Alberta
Bag One,Mail Room,Main Floor
North Tower,Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta

Dear Sirs,

I was not able to attend the November 16 open house but I do have some suggestions for the Clean Air Stategy for Alberta.

Regarding the problem of automobile emissions and greenhouse gases, would it not be possible to ensure that all motor vehicle emissions meet a minimum standard of acceptance?

The cost of meeting this standard should be met by the vehicle owner. It bothers me that so many commercial vehicles such as large trucks are allowed to emit so much visible pollution without any responsibilty to the damage done.

The owners of these offending vehicles, either individuals or companies, must be made to realize that the right to operate them extends to safety for the the environment as well as to people.

The standard could be achieved by a mandatory yearly inspection of all vehicles or by citizens reporting the offending cases to a regulating agency.

Efficiency gains of new improved cars is lost if people are allowed to drive them without proper maintenance.

Thank You

Derek Gomez
11319 - 25 Ave.
Edmonton, Alberta
T6J 5J1

161 Robin Crescent, Ft McMurray Alberta T9H2W4
January 3, 1991

To: The Clean Air Strategy for Alberta
Edmonton, Alberta

To develop a clean air strategy for Alberta, one must consider the policy of only burning our own toxic wastes and prohibiting toxic waste from entering our province. Pollution control expenses should be controlled by direct taxes on products either to the manufacturer or consumer. Our air should not be in jeopardy because of high consumption in Ontario. Other provinces should bear the expense and be responsible for their own waste.

Canadian and provincial laws should ban the use of hazardous and toxic chemicals which need costly removal methods.

We should be asking ourselves:

Not what our environment can stand
But what our environment can't stand

Yours sincerely,

D. Gordon

Can an Strategy
for Alberta.

I believe if diesel fuel was replaced with unleaded gas it would certainly give us cleaner air to breathe

Also if the trains were put back on track, one trip across Canada would take many passengers Plus thousands of pieces of freight would eliminate fumes from large trucks & passenger cars.

Also the damage on roads caused by heavy loads.

Yours Truly

Presentation to CASA Regional Session, Peace River Nov. 13, 1990

by Allan Johnstone, South Peace Environmental Association

I attended the Phase 1 Issues and Options Workshop for CASA held in Edmonton Sept. 5,6 and 7th. Ten of the one hundred delegates present were members of the Alberta Environmental Network. I represented the South Peace Environmental Association . I was the only environmentalist attending this meeting from north of Edmonton - the top half of the province. There was overwhelming agreement amongst the various stakeholders that global warming is the most immediate danger to our planet. The discussions therefore were centered on reduction of carbon dioxide (CO_2).

I have since spent two months travelling and studying the handout monograph entitled "Clean Air Strategy for Alberta." I handed out over 50 copies. I contacted a number of gas plant operators. I was surprised by the almost universal condemnation by knowledgeable oil company personnel of farmers conducting cattle operations as being the major cause of methane gas greenhouse pollution. To satisfy my curiosity about the documentation contained in the methane portion of the CASA monograph, I drove to Fairview and consulted with John Knapp, Director of Alberta Agriculture, Northwest Alberta Division. I gave him copies of the CASA monographs which he distributed to the thirteen agriculturists under his command. In a phonecall last week, he indicated to me forcefully in verbal terms that the percentage of enteric fermentation by cattle operations in Alberta is small. Specific quote, "To attribute massive amounts of methane gas from belching of cattle is ridiculous, and you can quote me." He mentioned that the Alberta Cattlemen's Association in Calgary have produced a technical document on this subject.

It is my opinion, based on consultation with various authorities, that the "Global Annual Methane (CH_4) Emissions" chart on page two of the Methane Monograph is incorrect and that gas and oil drilling, venting, and transmission is the number one cause of methane emission and flaring in the world today. The main source of methane venting and flaring is in Africa where in many countries unrestricted flaring burn trillions of cubic feet of methane and H_2Sgas yearly. Oil production in these countries is usually on a fifty-fifty basis between the oil companies and the local governments. In those cases, where the countries have environmental laws for gas emission, the oil companies comply. In those cases, where the countries have no restrictions on venting and flaring, the oil companies engage in unrestricted pollution in collusion with local governments. In many cases, the local, dictator-type governments cannot be controlled and the onus is on the oil companies to develop an environmental conscience. If not, there should be some type of worldwide environmental body formed who will have the power to hang these companies high in the sun.

Case History of a Grande Prairie County Oil/Gas Well

There are approximately 115,000 oil and gas wells in Alberta. I have chosen a well located two miles east of my residence in LaGlace as an example of what I feel is carbon dioxide pollution within the law. Paradoxically, the well is owned by Legal Oil and Gas. I have watched this well flaring on a hilltop for six years. The Energy Resources Conservation Board (the ERCB) records indicate this well was completed as an oil and gas well in 1959. The July 1990 ERCB records indicate that the average production for this well over the years has been ten to fifteen barrels a day, approximately four hundred barrels a month of oil. It has been flaring approx. 125,000 cubic feet per day, four to five million cubic feet per month of mostly methane gas. I do not have the complete figures for the past thirty years. I am aware that it has been shut down many years ago. If this well has been in operation twenty of the thirty years, it has burned off as waste over a billion cubic feet of gas into the atmosphere while producing 100,000 barrels of oil. The present monthly revenue of approximately 400 barrels of oil is twelve to fifteen thousand dollars per month for two truck loads of oil. At the same time they are burning off somewhere in the neighborhood of four to six thousand dollars in gas at wholesale prices. In the meantime, the forty dwellings in the little town of LaGlace where I have lived (I moved this week to Woking, Alberta) spend $50-$100 a month for heating at retail prices.

The major natural gas utility in the Grande Prairie area and in fact for a great deal of northwest Alberta and northeast B.C. is Northwestern Utilities, listed on the stock exchange, majority shareholder Ron Southern of Calgary, Atco Industries. In the case of this well, it is my understanding that pipeline-transmission facilities are in place but Legal Oil and Gas and Northwestern Utilities cannot come to terms.

CASA Solution

The production of oil in a well which also contains gas is legally dependent on the gas-oil ratio(GOR). I am assured by the ERCB that this well is legal (no pun intended). It is obvious to me that ERCB regulations in respect to combination gas-oil well installations have to be reviewed with the emphasis on environmental protection over the economics of oil production. The obvious solution in this case is that the ERCB, Northwestern Utilities, and Legal Oil and Gas should ensure the transmittal of this gas. The Amoco Gas Plant ten miles southwest is being enlarged 25% and is looking for gas. Otherwise, a solution strategy I have discussed with a knowledgeable industry acquaintance is the concept of gas garbage storage. That is, specifically, ~~in some cases that a well should be drilled nearby and the waste gas re-injected to a suitable reservoir and/or~~

if the operator of the new well is willing to burn off his waste gas, he should, in some cases, be forced to give it away to an adjoining pipeline operator. The decision to recommend this action should be the responsibility of the local ERCB office, not Calgary. The local councillor and district agriculturist should also be involved in flare reduction decisions.

It is my opinion, shared by acquaintances in the industry, that there are many more wells in the Grande Prairie area that flare more than the afore mentioned Legal Well. Indeed, it is my opinion that there are thousands of gas/oil wells in Alberta that should be reviewed and re-evaluated in respect to their GOR ratios. This could result, I believe, in a substantial reduction in carbon dioxide emissions in Alberta. No doubt, there will be howls of protest by Calgary-based oil companies surrounding the ERCB headquarters. However, the Environmental Law Society of Alberta have most emphatically indicated in their proposed changes to the Environmental Protection and Enhancement Legislation that the future of our children depends on a separation of economics from environmental law. It is my understanding that the ERCB is responsible to the Alberta Cabinet, and have been above reproach for many years. It has been my experience that they are mortal and subject to human error. I refer to the Calgary Headquarters. In 1980, I received documentation from the Hythe gas-plant proposal that my share of acid rain was five pounds per acre per year of the 15 ton-per-day output of this plant. Subsequent checking of the documentation of this fallout in a ten-mile radius of the plant was 1000% in error. My property received 50 pounds per acre per year as documented by ERCB. I must inject a personal note here. I paid $300 a month for ten years on my property (which I abandoned) and I sold the property in Oct. of 1989 for $7000. Six of neighbor associates at the gas-plant hearings ten years ago have experienced cancer. Three have died. I consider myself lucky.

CASA Recommendations

I maintain that methane flaring and venting into the atmosphere must now be considered an environmental crime. I recommend that each councillor in municipalities, improvement districts, and counties in Alberta request documentation from the ERCB of the flaring in their area in both metric and imperial measures. District Agriculturists should cooperate locally in this regard. It should be the responsibility also of farmers to report unusual flaring in the vicinity of their farms to the councillor. I visualize school children and school bus operators cooperating in monitoring wellsite and storage-tank flaring.

I will have more documentation to present at the Phase 3 Summary Workship in Spring 1991.

Allan Johnstone, Box 149, Woking, Alberta
Phone 774-2390

John Ludwick

ERCB predicting active oilpatch

By JOHN LUDWICK
Herald-Tribune staff

It should be a healthy winter in the local oilpatch.

That's what the Energy Resources Conservation Board area supervisor Dennis McCullough is predicting.

McCullough says with higher oil prices and the onset of winter, the area can expect to see more activity.

The area the local ERCB office monitors takes in 42,240 square kilometres, extending east from the B.C. boundry to about Fox Creek, and north to manning from Grande Cache.

In this huge chunk of forest, farm and marsh land the ERCB keeps a watchful eye our for about 100 small, medium and large oil companies plus a growing number of service related outfits.

To date 1,891 oil wells and 631 gas wells are in production this year. Oil production in the area ranges anywhere from 62,000 barrels per day in the summer and peaks at about 100,000 during the winter months. Gas production, meanwhile, averages roughly 400 million cubic feet per day.

Perhaps a more telling statistic is the number of shut-in wells in the region. The ERCB says 2,547 oil and gas wells are currently suspended. McCullough expects that figure should soon change.

"As the winter goes on I think you'll see a lot of those suspended wells freed up and start producing with the higher price of oil," McCullough says.

So far in 1990, 311 wells have been sunk in the Grande Prairie district. That figure is down from the previous four years.

In 1989, 457 oil and gas wells were drilled; 612 in 1988; 561 in 1987; and 474 in 1986.

And McCullough says it's unlikely the last two months of the year will see the number of new wells come anywhere close to previous totals.

But in fairness, he attributes the area's slow year to an unusually wet spring thanks to June flooding.

The number of oil producing facilities over the last five years has varied slightly with this year's total expected to come in just under the 1989 figure.

To this point 858 facilities are in production, compared with 875 last year and 1,008 in 1988.

Area gas plants, on the other hand, have seen a steady increase over the same period. October figures show 49 sweet and 22 sour gas plants in operation. That's 10 more than there were in 1989 and 12 more two years ago.

Another area where the district has imporved is in oil and salt water spills. This year there have been fewer spills than in the previous three years. McCullough's staff has only investigated 68 spills – most of them minor – compared with 114 in 1989.

He attributes the reduction to a more environmentally aware oil patch.

"More people are thinking green everywhere, and the oil companies are certainly no different."

The ERCB spends a lot of its time dealing with environmental matters, largely fielding complaints and acting as middlemen between the industry and public.

Its staff of eight inspectors also spends a number of hours on the road checking drilling and production operations, pipeline construction and testing as well as other duties.

The office was moved from Whitecourt to Grande Prairie in the

RESUME

Allan H. Johnstone
B.L. Site Box 38
Sexsmith, Alberta
T0H 3C0 Phone (403) 568-3364 BOX 149 INUVIK T0H 3D0 774-2390

1990

Experience:--Geophysical Investigator inspecting seismic crews and handling farmers' damage claims against seismic crews, with emphasis on water well damage occurrences. Managed the Grande Prairie Geophysical sub-office for Alberta Energy and Natural Resources, Minerals Division. (See attached job description) 1981-1984. Private consulting, 1985. Retired, 1986.

--Landman, Geophysical Consultant, developing and negotiating drilling plays; recommending drilling locations; surface permitting and damage claims work with farmers. (Central Alberta) 1970-1981.

--Geophysical Service Inc., Geophysical Computer Processing Party Chief and Data Interpretation. (Calgary) 1967-1970.

--Heiland Exploration, Calgary, Seismologist Party Chief responsible for crew operation and geophysical data interpretation for recommending drilling locations. 1956-1966.

Training: --Diploma, Petroleum Geology, Southern Institute of Technology, 1956.

--Computer Technology Diploma from Geophysical Service Inc., Texas Instruments, Dallas, Texas, 1967.

--Alberta Petroleum Landman License #1214, 1973.

--Alberta Realtors License #83176, 1980 (inactive).

Comments: --Foreign Geophysical consulting work in Pakistan, 1977.

--In periods of seasonal and political oil exploration recessions, other experiences include: auto wholesale partsman, hardware sales, oilwell pumpjack maintenance at Lloydminster, Alberta, pipeline labor foreman, and truck driving the Alaska Highway.

References: -Ron Gartshore,Yukon Gov't
Box 14,
Watson Lake, Yukon
Y0A 1C0
Phone (403) 536-2609 or 536-2232

-Craig Christie, Urban Development Consultant
4719-147A Street
Edmonton, Alberta
Phone(403) 437-4541

-John McCallister, Operator of Canuck Crane Services
Box 638,
Grande Prairie, Alberta
Phone (403) 532-8990

-Past Correspondences and References Attached
Enclosure 1-7.

HEILAND EXPLORATION CANADA LIMITED

EDMONTON, ALBERTA · CALGARY, ALBERTA

502-42 Ave S.E., Sub+P.O.28,
Calgary, Alberta,
20 Aug 56

Mr.Allan Johnstone,
Heiland Exploration Canada Limited,
Party 104,
Rosetown, Sask.

Dear Al:

It is with great pleasure that I advise you of your promotion from Computer to Seismologist.

I have been looking forward to this occasion since I first had your services on Party 104 when I was Party Chief. It can be said without reservation that the diligence and perseverence on your part toward your duties have obtained their just due in the way of this promotion. Continuation of this same attitude towards your duties in this or any other position you obtain along lifes highways will, I know, return rewards of similar nature.

Also effective September 1st.,1956 your Salary Rate will be increased from $325.00 to $350.00 per month.

Your promotion is effective immediately.

Cordially,

JHB/jbh

(J.H.Bush) Supervisor.

CENTURY GEOPHYSICAL CORPORATION OF CANADA
P.O. BOX 9700 • POSTAL STATION "A" • CALGARY, ALBERTA T2H 1Y2 • 287-1110

H.Z. Smith, P. Geoph.,
Vice-President,
Seismic Division.

16th June, 1981

TO WHOM IT MAY CONCERN:

RE: ALLAN HUGH JOHNSTONE

I have been acquainted with Mr. Allan H. Johnstone professionally and socially for over ten years.

Professionally, he has acted as a client representative for several seismic surveys which were conducted by Century Geophysical. It was obvious that Mr. Johnstone had extensive experience in all phases of data acquisition and field operations. At the time, he exhibited early concern for environmental damages caused by seismic activity and insisted on good housekeeping practices by the crews.

Socially, I have know Mr. Johnstone as a friend and neighbor and we enjoy a most friendly relationship.

Should you require any further information regarding Mr. Johnstone, do not hesitate to contact the undersigned.

Yours very truly,

CENTURY GEOPHYSICAL CORPORATION OF CANADA

H.Z. Smith, P. Geoph.
Vice-President
Seismic Division

HZS:sm

GEOPHYSICAL SERVICE INCORPORATED
906 - 12TH AVE. S.W. • CALGARY, ALBERTA T2R 1K7
403-245-6640 • TELEX: 038-22744

1981-06-25

TO WHOM IT MAY CONCERN:

I have known Allan Johnstone for the past fifteen (15) years, first as an employee and later an an independent consultant.

When I met Allan, he was already experienced in many aspects of oil exploration activity, and he has acquired valuable experience in the ensuing years in the modern arts of digital field seismic data collection and data processing. He also has background experience in seismic interpretation and most recently, as a landman.

He is an individual who works hard, and does so with a minimum of direct supervision. I would consider him a loyal and dedicated employee.

Yours very truly

Lorne G. Morris

Lorne G. Morris
Vice President

LGM/sri

GEOSOURCE INC.

P.O. Box 1087, Stn. 'M'
303 Forge Road S.E.
Calgary, Alberta, Canada
T2P 2L1
Telephone (403) 253-8281
Telex 038-24757

GEOSOURCE

June 16, 1981

TO WHOM IT MAY CONCERN:

Allan Johnstone is known by this company and more particularly by myself. He is considered to be of good reputation and in good standing. Further information will be submitted on request.

Sincerely,
PETTY-RAY GEOPHYSICAL DIVISION
GEOSOURCE INC.

K. E. Powell

K. E. Powell
Regional Manager

KEP/cw

(1)

THE ROYAL BANK OF CANADA
8TH AVENUE & CENTRE STREET
P.O. BAG SERVICE 2524
CALGARY, ALBERTA T2P 2M7

IAIN F. McLEOD
MANAGER

June 16, 1981

TO WHOM IT MAY CONCERN:

Re: Allan Johnstone

I am pleased to advise that I have known Allan Johnstone over the past twenty-six years. During that time Allan has been associated with the "Oil Patch" in a supervisory capacity.

He is a hard worker and industrious individual and I do not hesitate to recommend him to a potential employer as being worthy of full consideration.

Yours truly,

career and promotional opportunities

Alberta
GOVERNMENT OF ALBERTA

GEOPHYSICAL INVESTIGATOR

A Geophysical Investigator functions as part of a team covering regulatory work in the field of exploration and provides assistance to those who allege that they have had property damage resulting from Geophysical activity. The Investigator travels extensively throughout Alberta (30,000 miles per year).

DUTIES

Assesses damages to determine reasonable amount of claim.

Attempts to reconcile settlements between industry and the claimant by recommending to them the justifiable amounts for compensation.

Inspects the operations of Geophysical crews, from the commencement of the program to its completion, to ensure that the work complies with the Exploration Regulations.

Imposes penalties for violation of the Exploration Regulations and/or suspends the operation until the condition is rectified.

Research departmental records to establish the identity of companies whose previous work is causing current problems.

Supervises deparmental expenditures related to flowing hole plugging.

Reviews and approves all artesian well and spring plugging methods.

Assists in the preparation of regulations and directories governing Geophysical operations.

Conducts group instructional sessions with geophysical crews advising them of the Exploration Regulation and proper field techniques.

QUALIFICATIONS: Grade 12 education. Courses in water well drilling, hydrology or structural damage. Two years experience in geophysical operations, including experience in ind dealings and agricultural evaluations. Effective communication ability is a definite asset. An equivalent combination of experience and education will be considered.

APPLICATION FORMS may be obtained from the Departmental Personnel officers or from any of the Personnel Administration Offices, at Edmonton, Calgary or Lethbridge. Application forms must be received by the indicated closing date, stating position and competition number clearly.

SUBMIT COMPLETED FORMS TO: ALBERTA GOVERNMENT EMPLOYMENT OFFICE
5th Floor, Melton Building
10310 - Jasper Avenue, Edmonton, T5J 2W4

COMPETITION NUMBER EN 4040-2 CLOSING DATE July 20, 1981

PROFESSIONAL & TECHNICAL (O.G. #4) (LJ)

THIS COMPETITION IS OPEN TO ALL INTERESTED CANDIDATES

7/06/81

Alberta
ENERGY AND
NATURAL RESOURCES
Mineral Resources Division

File No.

Petroleum Plaza, South Tower, 9915 - 108 Street, Edmonton, Alberta, Canada T5K 2C9 Telex 037-3676 Mailing Address
Exploration Branch, 3rd. Floor, Victoria Place, 10009 - 108 Street Office Location

PRIVATE AND CONFIDENTIAL

April 26,1984

Mr. A. Johnstone
Box 500
Hythe, Alberta

Dear Mr. Johnstone,

The seasonal decrease in seismic activity has necessitated the elimination of your project position as Geophysical Investigator. This letter will serve as a formal notice of your termination effective May 18, 1984.

In order to give you an opportunity to seek alternate employment, there will be no requirement for your services over the three week notice period. Enclosed is a pension refund request form which should be completed and forwarded to the Personnel Services Division, 6th Floor, Petroleum Plaza, 9945-108 Street, Edmonton, T5K 2C9.

Any monies owing you will be processed as soon as possible and forwarded to you.

Thank you for your services over the last few years and good luck in the future.

Yours sincerely,

E. R. Silver
Executive Director
Exploration Branch

cc: K. Cairns - Personnel Services

3404 7th St. SW
Calgary, Alberta
Canada, T2T 2X9.

Dec. 11th, 1990.

Mr. Vernon Millard, chmn,
Clean Air Strategy Hearings,
Bag One, Mail Room, Main Floor,
North Tower, Petroleum Plaza,
9945 - 108 Street,
Edmonton, Alberta, T5K 2G6.

Dear Mr. Millard,

I spoke at the meeting in Calgary. I should like to repeat my main concerns and my suggestion and to apologize for an error. My concern is that we as a Province are not responding quickly enough to the threat of CO_2 legislation. My suggestion is that we may be able to do better than stabilizing CO_2 but that we must use tree growth to capture CO_2 and must not be trapped into speaking of emissions separately form absorption. My error was that I decided that the group had not gathered the required data. At the open house, I thought I was told that you didn't have data on CO_2 produced by gas flaring and several other areas of interest. When I spoke at the meeting, I was immediately presented with a copy of a paper listing all sources in the energy industry. I apologize for stating that this had not been done. I remain concerned that the group may not have data on the emissions by the forest industry, the absorption capabilities of forests and the reservoir potential of drilled formations.

Legislation

I suggest that we were lucky in the Green Plan released today and that targets may be raised several times before 2000. If Alberta doesn't act first there will be a carbon tax which may be more punitive than the NEP. Naturally Alberta will attempt to reason that the CO_2 produced in recovering oil for use elsewhere should be accounted for at the point of consumption. It won't work. In the final analysis the World Price of oil will be stated on a carbon tax free basis and we will be forced to compete. Whatever form the controls might take Alberta's oil will be more valuable if we can show that the Province is in carbon balance and that no penalty comes with purchase of our oil.

The present suggested CO_2 stabilization is stabilization at a level of emission that may be too high. Secondly, this presumes that the Third World will stabilize at their present levels which is most unlikely. If we were required to reduce our emissions to the Canadian average we would be required to go to 1/3 of present emissions. About the time that we have digested that crisis we may find ourselves asked to come down to some new World standard (say 1/6th of our present).

Forestry

Ontario Hydro came up with a figure for the hectares of forest to absorb their CO_2 emissions. I think their figures are suspect. It is probably best to use the forest industry's estimates of cubic metres of wood that can be harvested on a sustained basis. (less than $1m^3$/hec). We should know by now whether this requires 10% of the Province devoted to additional forests (as I suspect) or whether it requires some impossible proportion.

One major source of CO_2 emissions is the burning of slash. This could be eliminated by chipping the slash and using it as mulch to protect new growth and to restore soil nutrients. (I think this should also apply to so-called controlled burns in Parks) Even if it were necessary to pay the industry to change, it would be cheaper than achieving an equivalent reduction elsewhere. Your study states that it "does not include emissions from wood". This is ridiculous! Surely this was forced on your group by another Department. If our salvation is in harvesting more trees to capture the carbon, then the forest industry will gain from the need of the Province to grow vast new forests and they should be willing to cease burning slash.

If, as I suspect, this plan requires active forestry of some 25,000 hectares of new forest then the forest industry could double its most ambitious plans.

Agriculture

Many farms are becoming less economic and it should be possible to arrange mutually advantageous terms for farms which will convert permanently to tree forms. It also fits well with the aging of farm owners. Tree farm management will fit well with older farmers and with their urbanized children. The rest of us would all get sufficient joy from a a wider strip of forest along the foothills so that we would be willing to have it subsidized.

Municipal Waste

All municipal waste should be composted rapidly in concrete silos and then separated into soil and clean fill. This should include newspapers and garden wastes. Anything that's converted to soil fixes carbon. It could eventually help with our erosion problems. Recycling uses more trucks and much more road fuel and undoubtedly creates more pollution than it saves. Making new soil should give everyone a nice green feeling.

Balance

Others have spoken of a balanced carbon cycle in which biologic carbon (usually from aspen trees) is the fuel and the CO_2 which it releases is precisely extracted by the next trees grown in the same area. Our reason for being in Alberta is very largely the

great wealth implicit in the energy so cheaply available from our fossil fuels. I believe that we can create a balanced carbon cycle with the cheap fossil fuel inserted into the cycle in place of the wood which must then be used in some manner which retards release of CO_2 back into the atmosphere. Thus carbon is captured as soil made from composted paper or as lumber in an amount equal to the carbon released by fossil fuels in the Province. (I am presuming that we can take credit for the carbon in all exported forest and farm products since the CO_2 was extracted in Alberta).

Timing

If the greenhouse effect has already started then we are late starting. Announcement of a plan to become carbon balanced by the year 2005 might forestall federal legislation if it's made before the next federal election. If the trees were planted by 1995 they might be approaching maximum carbon extraction by 2005.

Public Acceptance

The public has heard the expression "lungs of the earth" so often that they now believe that a mature forest extracts carbon from the atmosphere. On balance a mature forest puts as much back as it extracts due to rotting and burning. They must be convinced that we must harvest and that we must do it in the most energy efficient manner (which is almost certainly clearcutting). The public will be more easily convinced, if at the same time we are doubling the forest in the Province and moving much of it closer to the cities.

Again, sorry for implying that your group hadn't studied the carbon emissions. If we're all lucky you may have studied all the other areas which I have mentioned here. If so please forward the studies and disregard my submission. Thanks in advance for any consideration you are able to give this submission.

Yours sincerely,

A.Hugh M. Jones P.Eng. F.G.A.C.

xc R.P. Angle - Sectn Head Atmospheric Dispersion
G.A. Capabianco - Coal Association of Canada
A.H. Zimmerman - chmn, Noranda Forest Group

6021 - 5th Street S.E., CALGARY, Alberta T2H 1L5 Tel. (403) 258-1280

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To: Clean Air. **Date:**

FAX: 427-2278

From: TONY & Penny Marshall
Box 25
ALDERSYDE, AB

This is a copy of a presentation which we made to our M.D. Council to appeal a development permit for an asphalt plant near our home. We were frustrated to learn that there are no clear regulations which are being enforced with regard to asphalt operations in this province.

Re: Development Application No. 90 6554
Portions NE 6, SE 7, and SW 8 20 28 W4
Continuation of Sand and Gravel
Mining and Washing

Burnco has been a good corporate neighbour over the years. Our children are the 5th generation to live on this farm. For a number of years Burnco has been crushing gravel across the river from our home, yes, there has been noise, yes, it has been dusty, and yes, bothersome but their operation has never posed a serious health concern. However, for the last few years, Burnco has also been leasing this pit to various asphalt plant operators. This has resulted in our quality of life being greatly affected. On numerous occasions (sometimes two or three times per day) our house, a short distance away from the plant, was engulfed in diesel-smelling dark grey smoke. At other times, the house was not engulfed but the smell of these emissions was bad enough to force us to remain inside with the doors and windows sealed. Since these operators only make asphalt during good weather, the exposure to unhealthy air coincides with the time we are out of doors.

While investing for this appeal, we have discovered some large loopholes regarding the regulations affecting the operation of these asphalt plants:

1. Legislation says that asphalt plants are required to have an air emissions test done and the results of this test on file with Alberta Environment before they can obtain an operating permit. However, this air emissions test is not done on a surprise visit by Alberta Environment! Rather it is prearranged by the asphalt company to have a private testing company come on site on a specific day and time. It is hardly a surprise that the plant is operating within regulations on the day of the test.

In addition this air emission test only measures particulate (number of dust particles in 1000lbs of air) and opacity (reading taken where the plume from the smoke stack is thickest, for six minutes to check obscurity of vision). There are no tests for hazardous or toxic emission exposures.

As you may already know, there will be changes to the existing regulations under the Clean Air and Water Act. They are currently being prepared and plan to be introduced in the Spring Session.

2. Because of the temporary nature of the asphalt operations, they are only required to file the above permit. But it is because of this fact that we have concern. There are no other conditions in place. A business licence from the M.D. is not required nor is a development permit. Thus we have found the responsibility for these operations jumps around between Alberta Transportation, Alberta Environment and the M.D.'s engineers for that particular job. So, when the air emissions from the plant are bad, we call Alberta Environment Air Quality. They inturn may

call the plant manager and ask what is happening. He gives some sort of explanation and then Air Quality will call us back and report that "it's just a start-up problem" or "it's just dust" or "it's just steam" or "it's just the way the wind is blowing" or "it's just temporary, don't worry about it."

In some cases Alberta Environment may actually visit the site. They drive into the pit in a marked vehicle and then make their inquiries. However, after about our fifth call to Alberta Environment, we asked the Air Quality Investigator, David Bensler, to come directly to our home and check the emissions from there. On that day he saw what it was we had been complaining about first hand. However, when he drove out into the field to get a better look at the plume, the plant was quickly brought back into spec and the air cleared after about 5 minutes. After noting this, he came back into our house to speak with us. After about half an hour he looked out our kitchen window and again saw dark grey diesel/asphalt smoke wafting past. The sad thing about this is that Alberta Environment Air Quality only tests for dust particulate.

When fossil fuels are burnt in the production of asphalt, they produce gaseous emissions which have varying levels of impact on the environment. These emissions include: carbon dioxide (CO2), sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC's) and methane (CH4).

These emissions, depending on the concentrations, can lead to acid rain and air pollution - both of which cause damage to lakes, rivers, soils, vegetation and most importantly, can result in serious health problems.

The primary concern in our appeal lies not on the face of the permit application which is before you today - namely, the "continuation of mining and washing sand and gravel" but in that which is not stated - specifically, the production of asphalt in close proximity to several homes.

As is typical of many things, the danger here lies not in that which we know, but in the unknown and unregulated. Looking at this application one can see on the surface a fairly innocent request to operate a gravel pit. What you do not see, however, is an asphalt plant spewing hazardous emissions into the air only a stones throw away from several single family dwellings.

Asphalt is a complex mixture of high molecular weight compounds with more than 25 carbons per molecule. It is the product of the distillation of crude oil.

The main constituents of asphalts are bitumens and varying amounts of sulphur, oxygen, nitrogen and such metals as nickel, iron and vanadium. Some asphalts are formed by the addition such solvents as kerosene which makes them more fluid and easier to handle.

Asphalts, which are generally referred to as BITUMENS, fall into many categories depending on the refining and additions of the various solvents.

The International Agency for Research on Cancer (IARC) has categorized bitumens into 8 classes. The category which concerns us is called straight run or penetration bitumen and is the term applied to the residues obtained from the distillation of asphaltic petroleums and pressure tars and is used primarily for road building.

The Encyclopedia of Occupational Health and Safety states:

> The effects on the tracheobronchial tree and lungs of mice inhaling an aerosol of petroleum asphalt and an other group inhaling smoke from heated petroleum asphalt included congestion, acute bronchitis, pneumonitis, bronchial dilation, some peribronchiolar round cell infiltration, abscess formation, loss of cilia, epithelial atrophy and necrosis.

The article continues:

> It was concluded that these changes were a general phenomenon caused by breathing air polluted with aromatic hydrocarbons....

According to the Government's own WHMIS CLASSIFICATION GUIDELINES section 6.2.6.:

> Exposure to bitumen fumes, aerosol or smoke, has been reported to cause patchy regions of emphysema, bronchial dilation, pneumonitis and severe localized bronchitis....

Section 6.4 of the WHMIS guide states that bitumen...

> ... and others of similar composition have the potential to cause skin cancer in laboratory animals.

This same document gives asphalt a Class D, Division 2B rating - meaning, vert toxic, poisonous and infectious. It concludes with a health hazard communication that...

> ... heating this product will result in the release of potentially hazardous vapours.

(ie:Has)

In terms that we can all understand, the emissions from this plant have the effect of dramatically reducing the air quality in this area. These emissions can affect human health, corrode buildings and machinery, produce eye, nose and throat irritations

and in the short term cause coughing, chest pains and other respiratory discomforts. Over the long term the effects can be much more serious and result in damage to lung tissues, contribute to chronic lung diseases and reduce life expectancy. In addition agricultural crops such as wheat and alfalfa are prone to damage when air emission concentrates are elevated - leaves are damaged, growth is reduced and susceptibility to insects and disease increases.

In conclusion, I would like to restate that historically, Burnco has been a good corporate neighbour and that it is more through ignorance than evil intention on their part that this situation has been allowed to exist.

However, I can not state emphatically enough, the serious nature of this problem. The health and well being of at least 14 people, 6 of them children, depend on you not allowing the continued operation of asphalt plants on this site.

The attached letter from Dr. Len Senger, physician, and Mr. Don Tannas, M.L.A. for this area, substantiate this appeal.

I urge you not to allow asphalt production on this property!

Susan E. Nelson
Box 237
Lundbreck, Alta
T0K 1H0
Dec. 18, 1990

Clean Air Strategy for Alberta
Bag One, Mail Room
Main Floor, North Tower, Petroleum Plaza
9945-108 st.
Edmonton, Alberta
T5K 2G6

Dear Madame or Sir,

Last Thursday I attended a Clean Air Strategy session in Pincher Creek. I was unaware of the purpose of the session, and I was disturbed to find that an attempt made by our policy makers to find out from Albertans what we want and expect in the way of a clean air policy should be so poorly attended.I was personally unprepared because my two main sources of information, the local newspaper, and the C.B.C. had not drawn it to my attention. Fortunatly, I am an avid poster reader, so I found out about the session the day before it happened.

Those who made presentations were not unusual, I suppose, in that they were all expressing their personal point of view. Many of the presentors were almost incoherent with emotion, indicating either severe stage fright, or how deeply they feel about the need for a definitive policy dealing with environmental degradation. What was unfortunate, from my point of view, was that those who were urging rapid and drastic measures be taken came off sounding hysterical and ill-informed, while those who urged a go-slow approach sounded reasoned and intelligent. I had to keep reminding myself that both the mayor and the gentleman from Sparwood had a vested interest in wanting no laws or limited laws. The mayor presides over a town that is becoming more and more dependent upon the exploitation of potentially polluting hydrocarbons, while the fellow from Sparwood was unabashedly promoting the coal industry. Sadly, he was the only presentor quoted in the local paper today.

One "fact" that the man from Sparwood kept stressing was that no one is sure exactly how all of the various pollutants we toss into the air is going to affect the world. Does he want the whole world to be in the same mess as Mexico City before he is willing to accept that hydrocarbons in the air are bad? Unlike him, I don't have a direct economic interest in coal, but even if I did, surely I would have the integrity to concede that sometimes what you don't know can hurt you.

I do not recommend a slow and cautious approach in the drafting of a clean air policy, any more than I would accept the advice of a doctor who suggested waiting a few months before doing anything about a lump in my breast to see if it really was cancerous. A doctor who would not take any preventative measures to save the life of his patient would be, at best , stupid, and at worst, criminal. Still, not all breast lumps are cancerous, and biopsies could endanger the life of the patient if she were allergic to the anesthetic, and the health care system is over used, and doctors and nurses are under paid, and , and , and..... But it's my health, damn it, and no excuses about the need to go slow will satisfy me! Yes, I am willing to forego many of the trappings of our modern society if it means our world will survive, just as I would be willing to accept the loss of a breast if it meant saving my life.

The presentors who took a conservative stance on the need for legislation expressed fear that tough laws would hurt the economy. I agree.* I also prefer economic pain to possible ecological death. I believe that the most effective way to end irresponsible use of resources is to make them very expensive. I recall when I could fill my gas tank for $5.00. Everyone drove everywhere. No one worried about wasting energy, and those who complained about exhaust were considered whiners. Then came the oil embargo of 1973. I was in Switzerland that Christmas. For the first time in my life I saw people making a concerted effort to not waste. No private vehicles were allowed on the road on Sundays. No store would give you a plastic bag, without a lot of pleading. A little old lady rapped on the car window one day and gave me a lecture because the car had been left running while the driver ran into the post office to mail a letter. No one complained. Everyone accepted these measures because they believed that if they didn't conserve they might literally freeze in the dark before winter's end. Less air pollution was a side effect of the conservation, and the conservation was encouraged by the extremely high price of gasoline and oil, as well as other petroleum by products. It was very much like a war situation where rationing was used. Back home there was a war too, but mainly at the gas stations in the States, where motorists often got violent if they thought the station would run out of gas before they got to the front of the line. Prices had risen, yes, but not enough to impress most people that we were in a crisis that demanded teamwork.

Some research was begun in those oil crisis days into finding alternate energy sources. Some alternate energies had the added attraction of being less polluting than our non-renewable sources. Some of us got very excited about solar power, and wind power, and hydrogen. Then the crisis seemed to peter out and even those of us who would have liked to rely on the new, clean energy, found that we simply could not afford the capital outlay it would take to be properly set up. So, we stayed with the electric power supplied by hydro and coal. We stayed with propane, or switched to natural gas. We made some concessions to the higher prices, by better insulating our houses, buying smaller cars, not leaving the Christmas lights on all night. A new generation has grown up with the higher prices, and accept them as the norm. They don't understand why Dad freaks when the t.v. is left on when no one is watching. They think that anyone who doesn't have at least two long, hot showers a day is deprived and possibly unhinged. They are even more attached to their cars than I was to mine twenty years ago. The only time they don't drive is when someone else offers them a ride. I went to university with young people who refused to use the public tranportation because it was uncool. The only way people with that kind of attitude will accept the need to cut back on the use of polluting, energy wasting luxuries, is to **make them luxuries.** Make energy too expensive to waste. Reserve cheap fuel for people who need it to make their living. Charge a surtax on Sunday driving. Make car pooling and public transport so cheap parents will force their children to use these methods. Don't allow anyone to park on the university grounds unless there are atleast two people in the vehicle. Subsidize alternate energy sources so that ordinary people can consider building solar heated houses, or creating their own electricity.

We are still hooked on cheap, accessible energy, and just like the cheap, fatty junk food many people are hooked on, it is at least going to make us unhealthy, and it may even kill us. As with any addiction, quitting is not easy. As with any addiction, we're not sure where it will lead. As with any addiction, there are three possible ways of quitting: We can keep using at the same or even faster rate until its all gone and we have to go "cold turkey"; we can try to taper off, and get the situation under control; we can meet the usual end for junkies, overdose and die.

I believe that the only sane clean air strategy is one that can be implemented in the shortest time, with the widest effect. No one can not do their part. This is a war, and those who don't take part are traitors to all of human kind.

Sincerely

C. Rice

– A clean air strategy for Alberta has to consider this issue. It was ignored in the ALPAC EIA Review, but cannot be ignored any longer. Ralph Klein says that Alberta's emissions standards are the highest in Canada. The Hinton pulp mill is living proof that these standards are not good enough. –J.R.

11 September 1989

Mr. G.J. DeSorcy
Chairman, ALPAC EIA Review Board
15 Floor, Standard Life Building
10405 Jasper Avenue
Edmonton, Alberta
T5J 3N4

Re: ALPAC EIA Review - Terms of Reference, Air Quality

Dear Mr. DeSorcy:

The terms of reference for the review of pulp mills in northern Alberta contains several important mandates to examine the effects of proposed pulp mill development on water quality. However, in the copy I received from the Hon. Ralph Klein, there is no mention of a mandate to examine and report on the effects the proposed pulp mills will have on AIR QUALITY.

Since some existing pulp mills in Canada have caused serious health problems due to air pollution, Albertans are naturally concerned about the effects that the proposed pulp mills in northern Alberta will have on air quality. Emissions into the atmosphere are not confined to any particular area and have the potential to affect a wider area and a larger number of people than water-borne pollutants. A comparison of total potential air-borne emissions from the proposed plants vs. existing plants that have caused health problems is required.

We request that you expand the terms of reference of the ALPAC EIA Review Board to include a complete examination of the potential effects on air quality in Alberta.

Yours sincerely,

Jim Rennie

Jim Rennie

cc/Hon. Ralph Klein
Minister of Environment
130 Legislature Building
Edmonton, Alberta T5K 2B6

jr1.02

July 12, 1989

Hon. Ralph Klein
Minister, Alberta Environment
130 Legislature Building
Edmonton, Alberta
T5K 2B6

Dear Sir:

Re: Pulp Mills in Northern Alberta -
Public Participation in Decision Making

The recent announcement of plans to build several pulp and paper mills in northern Alberta raises some very real concerns about public health vs. economic benefit.

During the process of developing E.I.S. plans, various experts will no doubt quote figures as being "acceptable" or "safe" limits for the release of waste by-products into the rivers and the atmosphere. In fact, the "safe" limits on some of these substances has not yet been adequately demonstrated, especially for highly toxic dioxins. The Alberta government should not be relying on industry to provide Environmental Impact Assessments, nor should it rely totally on "expert" opinion on what is a "safe" level of contamination to develop provincial standards.

Instead, Alberta Environment should be conducting its own independent comparative studies. Comparative studies should include comparison of the total expected released quantities of dioxins, SO_2 and other contaminants from the new plants with the released quantities that have caused health or environmental problems in other areas.

For example, the population of Port Alberni, B.C. has experienced serious lung disorders on a rate that is 12 times the national average, and the problem has been directly linked to atmospheric emissions from the Alberni pulp mill. Granted, the Alberni mill employs outdated technology, and the proposed mills in Alberta will have a more efficient process in terms of percent of contaminants recovered, but these proposed new mills will be producing larger quantities of pulp. How do these proposed new pulp mills compare in total emissions to the atmosphere with Port Alberni? How do they compare with Prince George, where health problems have also been reported?

As another example, how would total quantities of dioxins released from the proposed new pulp mills compare with the existing Grande Prairie mill? The Grande Prairie mill, as you are aware, caused significant dioxin levels in fish in the Wapiti River. The dioxins involved are the types known to be highly carcinogenic. The Grande Prairie mill is obviously hazardous to public health, and we should not build any more pulp mills that run the risk of repeating these dioxin releases. An improvement in the process for the proposed mills can easily be offset by the fact that the new proposed mills will be larger. A comparison of total quantities released to the water and atmosphere is required.

Considering the uncertainties involved in setting up meaningful provincial standards, one has to ask why it is necessary to licence all these new pulp mills at once. The Alberta government would be well advised to consider conditional approval, under the strictest regulations, of only one project using state-of-the-art technology and monitor that project carefully for several years before approving any more. The licence for this first mill should be conditional, i.e. if it doesn't meet strict standards, the licence is revoked. The responsibility should be put on the pulp and paper industry to demonstrate that it can build a pulp mill without serious environmental impact. To date it has not been able to accomplish this. If this more cautious "show-me" approach is not acceptable to the pulp and paper industry, then Alberta would be justified in questioning the industry's motives and integrity and in refusing to licence any new pulp mills. What could be more fair?

Since public health is at stake, we, the undersigned, request that Alberta Environment carry out independent comparative studies and hold frequent hearings with the public on this issue, and be prepared to accept public input. These meetings should not be limited to just the northern communities near the proposed pulp mills but should also include major population centres such as Edmonton, Red Deer and Calgary. Alberta is well past the stage where we have to accept risk to public health for the benefit of a few jobs.

Yours sincerely,

Jim Rennie

J. Rennie
4308 - 41 Avenue S.W.
Calgary, Alberta
T3E 1G4

cc: Premier Getty
Hon. L. Fjordbotten

Dale Desjardins

Terri Foster

Gene Frison

Dave Lovatt

Niki Schmidt

Richard Thompson

Dave Washenfelder

A Submission to the Clean Air Strategy for Alberta

Craig Schneider

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100% Recycled Paper

<<Humans are the victims of their own self importance, conceiving themselves to be at the centre of the world, surrounded by a vague environment. This mistaken inside-out world view has shaped and directed traditional religion, philosophy, science, and art. Hence the race's heavy thinkers have recognized as important only two relationships - man to man, and man to God. The planet-people union has been unsensed and unknown, excluded from serious thought.

The new reality, glimpsed from outer space, shows a marvellous global ecosystem - the Ecosphere - in which people are enveloped as one vital part among many. This is the outside-in panorama.>> [1]

A Brief Overview of the Problem

This panel has been mandated to look at energy production related emissions to the atmosphere in Alberta. Opinions were solicited on emissions causing climatic warming and smog. The most important greenhouse gas in Alberta is carbon dioxide. The effects of methane and CFCs also contribute but are not considered here because the energy industry is known not to be a big producer of these gases [2]. The components of smog are generally oxides of nitrogen (NOx) and sulphur (SOx) which, when combined with sunlight, produce ozone. NOx is directly related to emission of CO2 through combustion of fossil fuels, therefor any discussion of CO2 reduction will have the same effect on NOx emissions.

The release of sulphur oxides has been researched intensively in light of the acid rain problems experienced in eastern North America. It has been discovered that:

> "... it is extremely unlikely that, except in the immediate vicinity of point sources, there is any impact on any of these [crops, soils, surface waters] environmental components" [3]. The same study also concluded that the ozone concentrations that were being recorded were the result of long range transport from the northwest U.S. [3], and are thus not treated in this representation.

Given that the main culprit in the production of smog is NOx and that NOx sources are also CO2 sources I have chosen to deal only with the issue of CO2 emissions in Alberta.

Why worry about Carbon Dioxide?

It can be said that the only reason to fear CO2 in the atmosphere is the threat of global warming. Global climatic warming has not been conclusively proven to be the result of the greenhouse effect. This is largely due to a certain natural variability in the global climate. What has been proven is the ability of certain gases to trap infra-red radiation. It has also been proven that global temperatures have increased by approximately 0.6 degs C in the past century [4]. Finally we have proof that the composition of the atmosphere has also changed over this same period. "CO2 is up 25%, NO2 is up 19%, and CH4 by 100%" [4].

While we do not have the direct evidence that seems to be required to motivate people, there is at least as much evidence of the greenhouse effect as there is that acid rain is caused by gaseous sulphur emissions or that smoking causes cancer. The only other reason to hesitate is to question what harm a little warming will cause.

Why Worry About Climatic Change?

According to a 1989 study commissioned by various departments of the Alberta government, the climate of the province would become similar to that of present day Colorado if the current projections become reality [5]. This conclusion was arrived at using the best available prediction technique; the Global Climatic Model (GCM). The ability of GCM's to model climate change has been questioned but even if

we accept its validity we must also wonder whether it is such a bad thing that Alberta's climate should become more moderate. The more difficult aspect of climate to predict is that of variability. The same study concluded that climatic variability would increase and the result would be more frequent periods of extreme or even damaging weather. They outlined our need to understand these potential changes so that if nothing could be done to mitigate them, then at least we could help prepare for them.

Towards an Industrial Ecosystem

One of the difficulties of reducing our output of greenhouse gases has always been that it was assumed that all the reduction would be realised by reducing consumption. While reduced consumption of fossil fuels is inevitable, it is possible that through the more efficient use of these fuels we will be able to produce more end product per unit of energy and thus be able to develop new and affordable industries.

The idea is to look at industry the same way we view ecology. We must consider the inter-relationship of all the products, materials and energy consumed in the industries of a given area. To carry the idea further we can then look at all the end products - both waste and useable - and determine how they will integrate into the existing biological eco-system.

Today, when an amount of coal or gasoline is consumed, its energy is used to perform a given task, and its waste

products - CO2, NOx, SOx, and heat - are dumped into the atmosphere. If these so called waste products were used in other processes, then the increased production would bring in greater returns on the amount of energy used, and on the amount of pollution created [6].

This approach can be applied even at the smallest scale. For example, it has long been known that incandescent lightbulbs are more efficient at converting electricity into heat than into light. Yet we continue to use incandescent in situations where we have no use for the heat they produce, and where a more efficient fluorescent bulb could be used.

Any future programs or legislation should be constructed in such a way that they encourage the development of industrial eco-systems. The first step could be for industry to submit inventories of the inputs and oututs of their factories. These inventories would be available for all to inspect, and other industries would be encouraged to use their waste products. A possible second step would be to introduce some type of pollution tax (or carbon tax) that would help make it more economical for companies to find uses for their waste than dump it.

Practical Example of an Industrial Eco-system

In March of 1990 the media reported on an entrepreneur who was trying to market an idea for co-generation of electricity in Alberta. This man had developed a small electric generator that could run off of the gas flares that are often associated with oil wells in southern Alberta.

These flares are used to dispose of the small quantities of methane that are associated with oil wells. The amount of gas is so small that it is not economically feasible to trap it and transport it to market. It is however much cheaper to transport electricity so the generators can make the power almost affordable.

The problem is that it is still cheaper to burn the gas and then buy our electricity from a coal fired electrical plant. It is obvious that this is a waste of a natural resource. The difficulty lies in figuring out how to resolve the situation. Industry claims that the royalty structure encourages them to flare their waste gas. At present the provincial position can be summed up in the following quote; "If the waste gas is to have a value to the company, then a portion of that value must be paid to the province as a royalty" [7]. Industry would argue that it makes sense for the royalty to be waived in cases where it prevents the waste gas from being put to some practical use, but that ignores the underlying cause of this situation. Royalties are charged on all other resources, so why do they become a roadblock in this case? The reason that free dumping of waste has become an institutionalized policy. People fail to see why someone should be charged for dumping CO2, NOx and other toxic substances into the air. If the owners of the well lease were being charged a fee for the privilege of disposing of their waste in our breathing air, then it would suddenly be more economical to get every last bit of energy out of it before it was dumped.

Another angle to this story should also be considered. Why is it so inexpensive to make electricity from coal? It is mainly because coal is plentiful and relatively cheap. One of the reasons it is cheap is because its use is more harmful than other sources of energy and therefor it tends to be used as a last resort. If there were a carbon tax it would be made more expensive, due to its higher rate of CO2 per unit of energy produced [8].

If the concept of industrial eco-systems was adopted then the resource royalty and utility rate structure of the province would need to be adjusted in order to reflect the present day realities of an atmosphere which can no longer support industrial waste disposal.

The Armageddon View

There are many who would have us believe that because we are reliant on the production of fossil fuels to bring in royalties, we will lose the most when we try to reduce our CO2 emmissions by 20%. We potentially stand to lose the most because we are the largest per capita emittors of CO2 in Canada. I contend that if we plan ahead and get to the forefront of the inevitable wordwide revolution in energy production, then we will come out ahead. All one has to do is look at how Japan benefited from the last energy crises. Japan is a country whos industry is heavily dependent on imported fossil fuels, yet when the price for their fuels rose dramatically during the early seventies, they developped products that were more energy efficient and were thus in

greater demand and in the end came out ahead.

It brings to mind the anecdote about how when fuel consumption standards were introduced in the U.S., the North American auto industry hired 500 lawers to fight the legislation, while the Japanese hired 500 engineers; we have been struggling to catch up ever since. I think that it is time we quit fighting every environmental change in the courts and start fighting it in the factories and laboratories.

In order to avoid the comming industrial Armageddon, Alberta should stop viewing itself as a producer of fossil fuels and become a producer of energy. While the threat of climatic warming may force a global reduction in the use of fossil fuels, and of energy in general, there will be a huge demand for alternate sources of energy. This demand for new technologies could be met by Alberta if we get into this field now. It has always been a priority of the Alberta government to diversify the economy. I'm not sure that we need to diversify into other industrial sectors, it may be enough to diversify within the energy industry.

Conclusions and Goals

The discussion on the effects of the greenhouse affect will continue long after it becomes apparent that the climate is indeed warming. One only needs to look at the history of the acid rain problem to be sure of this. It is a fact that we have changed the chemical composition of our atmosphere. The radiation trapping properties of some of these gases are

known. Given that the effects of this warming are widely debated, and that the past history of humans changing the environment have been largely negative, there is a need to act now to reduce our outputs of CO2, NOx, SOx, and O3.

Because the most painless way of achieving large reductions in CO2 output (and at the same time in NOx and SOx) is through improved efficiency in the energy and transportation sectors; because Alberta is one of the largest producers of these emissions in the country; and because we will be strongly affected by reductions in consumption of fossil fuels by our customers, we should take the lead in developing efficient industries and alternate forms of energy. This leadership will enable us to maintain the standard of living of our people during a time when our primary resources are becoming less valuable.

As goals we should set out the development of industrial eco-systems through the incentive of full cost pricing on waste disposal. We should encourage the development of alternative methods of electrical generation. As a short term goal we should market our natural gas as a cleaner fossil fuel both within Alberta and outside. The most pressing need is to educate Albertans to think of this as an opportunity rather than as a disaster, and to lead the way in altering our industry and transportation systems.

1. National Parks and Climate Change Rowe, Stan J. Occasional Paper # 4, National Parks Branch, Canadian Parks Service, Environment Canada, 1989

2. The Greenhouse Effect and the Alberta Fossil Fuels Industry Wiggin, E.J. & Yurko, W.J., AOSTRA, 1989.

3. The Acid Deposition Research Program Summary Report. Legge, A.H. et al. September, 1988

4. Slowing Global Warming: A Worldwide Strategy Flavin, C. Worldwatch Paper 91, October, 1989

5. Towards a Strategy for Adapting to Climate Change in Alberta. Wong, R.K.W. et al. Alberta Research Council Publications, 1989

6. Des stratégies industrielles viables, Frosch & Gallopoulos. Pour la Science, août, 1990

7. Rick Orman, Personal communication, April 30, 1990

8. The Greenhouse Effect and the Alberta Fossil Fuels Industry Wiggin, E.J. & Yurko, W.J., AOSTRA, 1989.

November 28, 1990 Doug Shepherd - Medicine Hat

Presentation to Clean Air Strategy for Alberta

Ho Hum.

Here we are in the boondocks again to listen to the prattle of yet another fool.

It is too bad that we politicians have to go to the expense of listening to the prattle when we wont understand and will do what we intended to do in the first place.

At least our form of good government gives the feeling to all that they were heard. That's great politics. The idots are too stupid to know that they have been had. If we had true party politiucs then those who did not pay would be kept out of this meeting.

Look at the success of the Oldman Damn. Lethbridge needed extra water to supplement the 25 cubic feet per second that occurs during cold winters. We now have that plus the water to irrigate rough land where the heat units are low and oats and forage are the preferred crops because of the short growing season. We have the natives upset. We have confrontation with the federal government which always gets votes. if we really look like idiots to the remainder of Canadians then we can claim that we were misquoted. The project was a success because Quebec had to get out the army to handle the problems created by their insensitivity. Our educational system is being downgraded to meet our personal standards so given time we will regain respect. All is not lost because we have asked Quebec to help us and they have most of our $100 billion removed by the NEP and they will spend it here to make us look good.

The basis for a clean air strategy seems to be that "Energy" is the enemy and those that use it are also. Cattle produce methane as do people and now we hear that beef cattle are the enemy also. We have known for a long time that people are in the way of this government.

My first question seems to be that in this age of manipulation by unknowledgeable politicians how many dollars have been wasted thus far? People no longer matter for they have been harnessed as a crop of taxpayers.

How many uneducated emotional fringe groups have been attracted because of inaccurate incomplete information and how many truly competent experienced people will observe in horror this latest government farce.

Nuclear Power had the potential of being the non polluting panacea for the future.

Let us thank God that the politicians have successfully performed their black art and demonstrated that without doubt there must never be another nuclear plant built and that hopefully we can successfully dismantle and clean up what is already in existence. We have seen a generation of incompetence, confusion, duplicity, dishonesty, patronage, etc. You can add more adjectives which the politicians have taught us to associate with them and their entourage and the failure of a power source that could have assured cleaner air.

For the purpose of this meeting, we are discussing Applied Thermodynamics, that branch of physics which treats of various phenomena of energy, and especially of the laws which govern transformations of energy. Thermodynamics has ramifications which extend into the fields of chemistry, electricity and astronomy. We must know how to successfully, economically and efficiently work with the phenonema which convert energy to heat which is in turn transformed into power and work and by appropriate processes of heat transfer and further transformation, refrigeration or a cooling effect by which a cooling effect may be obtained.

This science is not easily understood and is not aided by the contemporary political process.

Example # 1

The great energy crisis of 1972 was not an energy crisis for there was no shortage of energy. There was a shortage of money to buy energy because of a political philosophy. OPEC struck and the race by politicians to create confusion shifted into high gear.

The more serious crisis of the time was the protein shortage which has immense ramifications. Of great interest is the project which was to have soybeans (an excellent protein source) grown in Alberta but this project is on the back burner until panic time. Back to hydrocarbons for fuel.

A gasoline engine operates on the Otto cycle. This cycle is more efficient if the compression ratio of the engine is increased. Our politicians introduced legislation to decrease the compression ratio of the engine (decrease efficiency) which caused increased consumption of fuel per distance travelled. More heat was rejected per unit of distance travelled. Yes we have successfully used our brilliance to directly add to global warming. Our politicians have not been eating Brocoli! They say it makes you smart!

Yes you say, but cars now travel further on the same amount of fuel. Of course they can. The cars are smaller, lighter, more complex, suffer greater damage in accidents, have engines which rotate at higher speeds and wear more quickly etc. This is political progress.

Otto cycle automobile engines are not efficient. Electrical generation of power is more efficient. Immense amounts of power are generated at thermal generating stations but are we extracting all the energy that we can? Attractive alternate non polluting travel by electrically powered trains has not been introduced. Trains are being abandoned. We are blamed for not using the trains so we lost the service. Just who but a politician has the mentality to expect people to sit and wait hours of days for a train to arrive?

Small high speed engines are less efficient than large slow moving engines so with great logic, diesel engines are undersized and over injected causing black smoke from unburned fuel.

What happened to the electrically driven trolley bus?

To compensate for the problem of the overinjected compression ignition engine, the so called diesel engine, Jake Epp the federal Minister of Energy came to Medicine Hat and announced a program costing millions of dollars to replace diesel fuel with methanol. Dollars and taxpayers we have. Common sense we dont need for we are the government.

Natural gas has a higher heating value of 23,650 Btu.per lb. of fuel. Methanol has a higher heating value of 9,600 Btu. per lb. You can look at the 14,000 Btu per lb. dissappear as vapour on a daily basis from the methanol plant. The process leaves low quality energy which adds to the global warming in the form of water vapour as low grade heat but is in not smarter to use this energy than to waste it on global warming with nothing in between?

We know now that dinosaurs lived for about 60 million years on earth. These creatures had a small brain. I have it on good religious authority that the date is year 5751 In this short period of time man has indeed made an impact. Party politics has been around for about 200 years so our march to extinction perhaps should be measured with that yardstick. If you join the party then you can achieve full citizenship without education experience or ambition. If on the otherhand you educate yourself, work and gain wide experience then you sit on the sidelines and observe the new society and the parasites who qualify for work because of the payment of a fee to join the self annointing fools who now spend 60% of the Gross National Product and are being successful only in driving the country into third world status.

We Canadians live in an environment which is often hostile. We are great consumers of energy much of it by necessity more of it by sheer ignorance. What we have observed as the imposed lifestyle in the New Canada is an attempt to harness the taxpayers to serve ignorance in perpetuity. To add to tax revenues by finding excuses to tax fuel serves to improve the ego trip of the politician and entourage. It is not an attack on pollution.

Architects seem to design using odd shapes which are classic designs for heat loss. We see building materials used which transmit a great deal of heat. Look around this city or any city. Our government uses architects to perform engineering projects and we simply look in horror at the waste of energy so we surge toward third world status with pleasing visual impact.

Our puny and limited human capability has produced much but there are limitations because of materials available to accomplish what we must in efficient energy usage. One of the great limitations is the failur to produce and use materials and processes which use heat at high temperatures.

We hire consultants who use yesterday's technology and mentality but today's politics to to us recommend that massive quantities of energy for years be wasted. We have developed a system where red tape, petty power struggles, juridistional infringement, slothfulness, ignorance, self image enhancement,tradition, fear, self comfort and a host of modern sophistications to life have eliminated progress in Alberta. How many Albertans have left the province never to return because of closed doors and ignorance fostered in Alberta by those who with limited education and experience have dug themselves in for the duration. We live with the brutal reminder that management science as we know it today evolved about 1900 and for the first 50 years, the major management researchers were ignored and now we look to Japan to bring to us what our management researchers discovered in the nineteen twenties.

Those whom we defeated during the second world war and later have had their counties devastated by war are now sought after to loan us money and to bring us technology because our politicians are destroying the nation through sheer parochial ignorance.

We appoint Energy Resource Conservation Boards and the appointees listen to submissions. I attended a presentation hoping to hear a discussion of efficient use of energy and came away a day and a half later after hearing hearing of jurisdictional, rates, and other problems, not energy. Later a decision was issued on the Medicine Hat power plant which has the possibility of becoming the most energy efficient plant in Alberta with the least pollution and the desicion was to favour the less efficient plants that pollute.

To me the whole process is incredible that we politely tolerate an attack on intelligence by our politicians and their appointees. When can we expect a housecleaning and move into the 20th century? It is nine hears plus one month before the twenty first century.

We write letters to participate in the increase in the use of renewable energy and the letters are not answered by the civil servants.

We observe Marcel Masse, the federal Minister of Quebec Patronage fly to Medicine Hat to take credit for the waste of money for Methanol powered busses. The cost of a trip is reported to be $18,000 and what is the amount of fuel consumed on operation stupidity for his morning of basking in his own stupidity?

Is it smart to use natural gas to boil water? Not really. The temperature within the flame is over 3000 degrees Fahrenheit and the water boils at 208 degrees. Part of the implication of the second law of thermodynamics is the Law of Degredation of Energy. Simply put, energy must be used at the highest possible temperature to avoid waste. processes must be used so that there is a minimum temperature loss during each process. When do we accept the common sense of the situation and start to use the people with the education and experience rather than the friends of the politicians who have paid the final fee to achieve full citizenship?

To use the heat from Natural Gas to drive a gas turbine is contrary to the pontification of an Alberta Premier. The waste heat from this gas turbine generating electricity is at high enough temperature that a modern steam turbine with steam at dull red heat temperature will drive an efficient regenerative reheat turbine with steam bled off in appropriate quantities as the economy and thermodynamic requirements of the situation dictates. As the heat lowers in temperature then residual processes must be found to complete the obligation of our efficient use of energy and thus less pollution. When do our economic studies include social needs?

I have read the glossy brochures issued by this group and inquired as to who will finally absorb the information and make legislation. This project has the possibility of making the Oldman Dam project live as a memory of exquisite social, environmental and technical excellence.

Since my return to Alberta 16 years ago I have written and presented many briefs. I have spent thousands of hours studying, reviewing and adding more information. I have proofread and reread and consulted and have had audiences come from afar in the hope that I will be able to make an impact where they have failed but what we Albertans face is a closed minded monolithic monster which is unable to act and progress as others do.

The contempt for the citizens of Alberta which is plainly expressed by the politicians, their absymal display of lack of education and experience, their quaint parochial views, bunker mentality and hiding the facts has led us to a point of no hope of progress in the future.

The offer of money to corporations from outside Alberta to maintain industry here, the denial of the same opportunities to those who will eventually leave because on no opportunity to participate in life in Alberta makes the choice of a foreign

culture or country a preferred alternative to participating in the degeneration of society by paying taxes to support incompetence.

We have observed the knee jerk reaction to pressure groups to gain votes only to see this result in the long term abuse of the citizens of Alberta and damage to investors who at one time had confidence in our government.

We have now groups of civil servants holding a public meeting so that their bosses can ask the question " How can you have such negative thoughts about a bunch of nice guys like us?"

My god when will politicians learn how badly they are screwing up everything they touch?

CLEAN AIR STRATEGY FOR ALBERTA

Submission by Dave Sheppard, Box 102, Pincher Creek. Nov 26,1990

As a concerned citizen I wish to make the following points:

1) Energy Conservation.
The single most effective thing Alberta can do to alleviate global warming is to institute a comprehensive energy conservation program. Have we a program in place at the moment? If we do, few people know about it, and even fewer follow it.Governments must lead the way in energy conservation by setting an example, and this example must be well publicized. As a whole, present energy conservation programs do not seem to be effective. Why is this?

2) Alternate Energy.
Any fossil fuel consumption that can be replaced by alternate energy sources is a gain for air quality. Alberta does offer some support for the development of alternate energy, but needs to do much more.

3) Energy Efficiency.
Can government set energy efficiency standards for various industries? for appliances? for vehicles? Can government offer incentives and awards for energy efficiency? Can government motivate manufacturers to reduce packaging?

4) Air Quality Standards.
If Calgary air, for example, is rated clean by existing Provincial air quality standards, then the standards and controls are inadequate because Calgary air is often very foul and unfit for human consumption.

5) The Forest Industry and Global Warming.
The forest industry contributes substantially to global warming through:
a) the burning of slash, mill waste, and forest fires;
b) the removal of forest cover on a large scale and the subsequent release of stored CO_2 to the atmosphere;
c) the removal of trees which absorb atmospheric CO_2;

d) the scarification and disturbance of forest soils which "burns" humus rapidly, thereby releasing more stored CO_2.

There are very few days any more when our beautiful mountains standout sharply and clearly. Most of the smoke in the Pincher Creek area comes from forestry operations in B.C. and the United States, a transboundary problem. Solutions?

a) less logging.
b) greater use of selective logging.
c) reduction of waste.
d) banning the burning of slash and mill waste; replacing it with chipping, or scattering of slash.
e) banning scarification.

6) Volatile Organic Compounds (VOCs)

I find it hard to believe that the spraying of pesticides is not a major contributor of VOCs in Alberta. It is not mentioned in your handout.

7) Sulfur Gases

More needs to be done in controlling sulfur releases from oilsands plants, oil refineries, gas processing plants, coal-fired generating plants, and other sour gas and oil facilities and processes such as wells, welltesting, compressors, pipeline cleanout, etc.

There has been much improvement in recent years but more can and should be done. As the second leading source of SO_2 emissions in Canada, Alberta may be contributing to the acidification of susceptible lakes in other provinces and territories downwind.

Relative to population, Alberta is an excessive contributor to global air quality problems, and these problems are very serious and perhaps even life-threatening. We owe it to our children and grandchildren to do all we can to reduce our contributions to global air pollution, even at the risk of reducing short-term economic growth, or sacrificing that third car in the driveway. Clean air is not just a matter of simple-minded economics; it is also a matter of survival. Which is more important?

Thanks for considering my submission.

LIGHTING POWER CONSERVATION IN OFFICES AND CLASSROOMS

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ABSTRACT

Very little seems to be known about optimum lighting conditions for classrooms and offices. For this reason a large savings potential in the area of lighting power is often neglected. The lighting designer tends to consult the local building code. In Alberta the building code happens to call for 800 lux*) for classrooms. Alberta Education, however, recommends 500 lux, and an environmentally conscious country like Sweden decrees 200 lux as sufficient.

Starting out from these wildly differing recommendations, this paper will try to shed some light on the biological findings that will help to select the proper lighting level and provide some technical information on choosing economical solutions to achieve low power consumption. At Edmonton Public Schools, reductions of lighting power consumption tended to be around 30 - 50% in classrooms and offices.

An information campaign that makes users aware of the benefits of lower lighting levels is the most important step prior to delamping or other reduction of lighting levels.

*) 1 foot candle (fc) = approximately 10 lux.

1. NEED FOR A REVISION OF THE BUILDING CODE WITH RESPECT TO LIGHTING LEVELS

Lighting level recommendations have undergone dramatic changes over the last fifty years. The Illumination Engineering Society's (IES) lighting handbook that so far has been considered the basic reference, over the years has received considerable input from the lighting and power industries (1).

A good example for these rising lighting standards are those for schools in the New York City Public School System. Illumination levels recommended for classrooms were increased from 20 foot candles (fc) in 1952 to 60 fc in 1971; while 20 fc lighting levels were deemed sufficient for libraries in 1952, 70 fc were called for only 20 years later (2).

Could the eyesight of the nation have deteriorated so much in so short a time? As a matter of fact great effort was expended in proving a relationship between levels of illumination and the efficiency of performance of visual tasks. This research came out in 1959 as the Blackwell Report (3). The findings of this report are the basis for today's high illumination standards.

Blackwell devised experiments to measure visual performance for both static and dynamic tasks and a device called a "visual task evaluator." Appel and MacKenzie produced a critique of Blackwell's work that culminates in the question if a 4% increase in the accuracy of performance of artificially designed laboratory visual tasks is worth a doubling or tripling of foot candle requirements (4).

After 25 years of research into lighting requirements for reading, Tinker made the following statements cited by Dumas in "The Conservation Response": " ...visual acuity increases rapidly as light intensity is increased from a fraction of a fc to 5 fc and then gradually up to between 25-40 fc. As the illumination intensity is further increased up to 100 fc or even above 1,000 fc, the improvements in acuity are slight. Although the gains in acuity with itensities above 50 fc may have theoretical implications they have no practical significance for reading (emphasis added)." Tinker further concludes: "Gains in acuity when illumination intensity is doubled, are very slight for levels above about 20 fc. It is questionable whether the almost microscopic gains in visual acuity obtained under the relatively high fc of light justify their application to visual tasks such as reading..." (5). Figure 1 has been designed using the above description. Lloyd Dumas is of the opinion that excessively high levels of illumination will reduce the efficiency of performance of prolonged visual tasks, despite the slight gains in visual acuity they produce, by increasing eye fatigue.

Lloyd Dumas concludes: "...it seems clear that illumination intensities in excess of 20 to 50 fc are simply not justified by any significant gains in the performance efficiency of reading or other similar visual task."

At Edmonton Public Schools I found school offices that had been delamped by secretaries from about 100 fc to half that level or less in order to eliminate headaches that bothered them under a

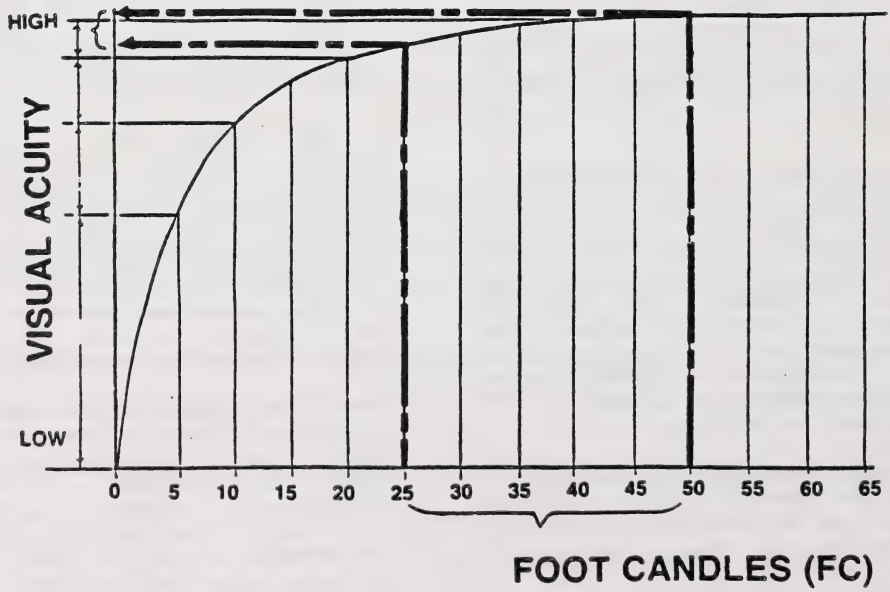

Figure 1. APPROXIMATE EFFECT OF DOUBLED LIGHTING INTENSITY VS. INCREASE OF VISUAL ACUITY

lighting level considered optimal by IES and Blackwell. A colleague of mine, Peggy Evans, Assistant Principal at Brander Gardens School, made the following remarks (6) about an experiment she conducted in one of her classes: "In one classroom where I reduced lighting levels to approximately 45 fc, I found my students enjoyed the change to such a degree that they pressured me to reduce it even further. A summary of their comments indicated that this environment was friendlier and not as harsh. They found it easier to concentrate. Those wearing eyeglasses appreciated the reduction in glare and thus experienced less eye strain."

Other teachers at Edmonton Public Schools reported that turning some lights off in a classroom was an effective means of calming students down.

Peggy Evans also cited research by Drs. Ken and Rita Dunn "that reported brightly lit classrooms made some children fidgety and nervous. These students also displayed symptoms associated with various degrees of hyperactivity. The Dunn's also recognized that others found the brightly-lit room invigorating. These children became lethargic in a dimmer environment. [They did well under lighting levels of 85 fc.] Other students displayed no preference whatsoever for either lighting condition.

Drs. Dunn also found that poor readers tend to perform better in dimly-lit environments. Good readers were found to be equally right and left brain learners, but 82% of poor readers were found to be right-preferenced.

Right-preferenced learners were found to prefer low lighting. What Dunn and Dunn concluded was that <u>some</u> children are strongly affected by the lighting level in their learning setting and that this can be a key factor in their achievement. What this suggests to me is that the lighting levels in class, especially those catering to special needs children, should be re-examined."

Everyone is aware that the pupil of the eye closes more and more as the lighting level increases. The strain on the eye muscle to keep the pupil closed to a small aperture would explain the headaches developed by some people after prolonged exposure to high lighting levels. John Ott (7) reports of an experiment with two contact lenses, one of which was ultraviolet transmitting, the other not. When applied to the eyes of a test person under artificial lighting without a UV component, both pupils were of the same diameter. In daylight, however, the pupil with the UV- transmitting lense closed more than the other one. This indicates two things:

1. Our eyes are capable of recognizing the non-visible ultraviolet light.
2. The cool white fluorescent light would appear brighter than the identical level of daylight.

Tinker's research shows that people will develop a preference for a lighting level to which they have adapted. In one case he allowed a group of subjects to adapt for 15 minutes to diffused light producing 8 fc of illumination. He then varied the light intensity and asked the subjects to choose which level of illumination they found preferable for reading. Most chose 8 fc. He repeated the experiment allowing 15 minutes of adaptation to a level of 52 fc. Now the subjects most often chose 52 fc. From this Tinker concludes: "Apparently, by picking an intensity and adapting the reader to it, one can obtain a preference for that intensity. If the investigator is interested in promoting use of lights of high intensity, the method of preference will support it."

Further, Tinker found that after a period of adaptation to levels between 3.1 fc and 53.3 fc, the speed of reading was the same.

Dumas (9) states: "One of the reasons why the Blackwell experiments are misleading is that they deal with completely unpatterned tasks, whereas the vast majority of real world tasks involve some degree of patterning. They are therefore far more relevant to the

setting of illumination levels for tasks like gauge reading and finely detailed industrial visual inspection than for reading, writing, etc."

Obviously such intricate tasks would best be performed under task lighting without flooding the whole room with blinding light.

An investigation at the George Washington University and the Childrens' Hospital National Medical Centre in Washington, D.C., concluded that severe damage of the eyes, leading in some cases to blindness in prematurely born children, is enhanced by the comparatively bright and constantly burning lights at pediatric intensive care stations. (10). Another proof that established health care does not always know what is good for our health. A lighting engineer like Blackwell, therefore, can much less be blamed for not knowing the health implications of high lighting levels.

Authorities that enforce lighting levels should be careful, however, to err on the side of safety.

I, therefore, plead for a revision to lighting levels recommended for classrooms, day cares and offices to levels that are closer to those recommended in Sweden (200 lux) or West Germany (350 lux).

2. POWER CONSERVATION THROUGH DELAMPING AND INCREASED LIGHTING EFFICIENCY

In 1983 Alberta Education issued lighting recommendations for classrooms of 500 lux, that had been introduced in Ontario already in 1981 by that province's Department of Education. At Edmonton Public Schools lighting levels prior to 1983 ranged between 700 - 1200 lux. After presentations to school staffs on the benefits of lower lighting levels, we proceeded cautiously by having custodians remove the tubes of fixtures to be delamped. After a week or two of getting used to the lower lighting levels, permission by teachers was obtained to permanently disconnect ballasts of delamped fixtures.

Fig. 2 Comparison of Illumination Recommendations for Schools

Areas	*IES (USA)*[a]	*IES (Britain)*[b]	*NYC Health Code*[c]	*Tinker*[d]
Classroom	70–150 fc	20–30 fc	30 fc	20–30 fc
Library Reading	30–70	30	30	15–35
Office	70–150	30	–	15–25
Drafting/Sewing	100–150	70	50	40
Washroom/Locker	20–30	7–10	10	–
Laboratory	100	30	–	–

[a]Derived from recommendations in the 1972 *Lighting Handbook* of the Illuminating Engineering Society of the United States.

[b]Derived from the 1961 lighting code of the British Illuminating Engineering Society.

[c]Derived from the 1959/1964 New York City Health Code.

[d]Derived from the recommendations of Miles A. Tinker.

Sources: Adapted from Richard G. Stein and Carl Stein, *Research, Design, Construction, and Evaluation of a Low Energy Utilization School* (Washington: National Science Foundation, August, 1974), pp. h-2/1 and h-2/2; Miles A. Tinker, *Bases for Effective Reading* (Minneapolis: University of Minnesota, 1965), pp. 233–234. in Lloyd Dumas' "The Conservation Response", 1976, pg. 91

There were a number of teachers who had more faith in IES than in the words of an energy consultant whom they suspected to be motivated mainly by his desire to conserve energy. Their lighting levels were not changed.

On the other hand we had many positive comments from those who consented to delamping. In the case of 4-tube fluorescent fixtures, two tubes were removed and one ballast disconnected. In classrooms with three rows of lighting frequently the middle row was disconnected, and in other cases every second or third fixture was delamped. This created a symmetrical checkerboard pattern and appealed to the sense of orderliness of teachers.

Care was taken not to remove fixtures at the end of rows. This measure provides more wall reflection and helps to maintain a more cheerful classroom.

In corridors where delamping would have created dark spots, so-called power reducers were installed in line with the ballast. Power reducers change the wave form of power supplied to the tubes and can be selected to reduce power consumption between 25 and 50%. This results in an equivalent drop in lighting level. At the same time the temperature of ballast and tubes drops by an amount sufficient to double the life of a new ballast. Power reducers cost less than a ballast.

A few years ago manufacturers of power reducers experimented with cheaper diode type reducers that proved unsatisfactory.

The coil type power reducers have proven reliable so far. The first we installed 5 years ago and none of them have failed.

Electronic ballasts that provide a power reduction of 33% with constant light output will take over the market in the next few years as they become cheaper.

The Wilson ballast that is presently being developed in Edmonton has a second feature: A switch on the ballast allows to gain 55% in power saving if a 13% drop in lighting level is acceptable.

Another Edmonton firm showed us a highly polished reflector that allows to convert two-tube fluorescent fixtures into one-tube fixtures, resulting in 50% power savings with only a 5% loss in light output. The combination of electronic ballast and high reflectance one-tube fixture, therefore, could lead to further dramatic reductions in lighting power usage even in delamped buildings.

3. REFERENCES

(1) John Appel and James MacKenzie, How Much Light Do We Really Need?, Bulletin of the Atomic Scientist, December 1974, pg. 19.

(2) Lloyd J. Dumas, The Conservation Response, D.O. Heath & Company, Lexington, 1976, pg. 80.

(3) H. Richard Blackwell, Development and Use of A Quantitive Method for Specification of Interior Illumination Levels on the Basis of Performance Data, Illuminating Engineering, (June, 1959).

(4) John Appel and James MacKenzie, Op.Cit., pg. 20-24.

(5) Miles A. Tinker, Bases for Effective Reading, Minneapolis: University of Minnesota, 1965, pg. 226.

(6) Peggy Evans, Effects of Lighting on Student Learning and Achievement, Edmonton Public Schools, 1987, pg. 1-2.

(7) John Ott, Health and Light.

(8) Miles A. Tinker, Op. Cit., pg. 208-209.

(9) Lloyd J. Dumas, Op. Cit., pg. 84.

10) Frankfurter Allgmeine Zeitung, August 21, 1985.

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Jan 14th 1991

Alberta Environment
Alberta Energy
Alberta Forestry

Re: Clean Air Strategy

Health is one aspect of life most precious to most people. It seems only logical that we do the utmost to assure substantial reductions of CO_2, NO_x, SO_x, O_3, CFC, and VOC levels in Alberta.

From our perspective it is not good enough to fail world standards for clean air. Instead we should lead them, especially in the face of increased health threats to Albertans (highest asthma death rate in Canada, for example). Also, because we have the highest per capita CO_2 production.

We support

- a carbon tax, and or
- higher fuel prices (the reasons for this action have to be sufficiently explained to the public)
- energy conservation (low cost/high profit)
- highest environmental standards and law enforcement for existing and new industries
- reformation of agriculture towards non-chemical methods (avoidance

p.t.o.

of nitrogen gas release) :

- no more clear cutting in Alberta (because we need <u>more</u> CO_2 absorbing trees not less)

We appreciate:

- information packages or leaflets as well as radio and TV education for the public (example: "Clean Air Strategy for Alberta")
- public participation throughout environmental decision making processes and beyond
- better environmental law enforcement than previously experienced

H - Stoyke
Godo Stoyke
Shanthula Manoharan.
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December 11, 1990

Clean Air Strategy for Alberta
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North Tower, Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta
T5K 2G6

Dear Sirs:

I am writing in response to your recent advertisements inviting written submissions in connection with the "Clean Air Strategy for Alberta" initiative.

The issue that I would like to see addressed is vehicle emissions. I am appalled at the number of vehicles on the roads in Alberta that spew out overly polluted exhaust fumes. In many cases, these vehicles will be travelling in a cloud of smoke (of their own creation) that you can smell many car lengths away.

I have tried to file complaints in the past against particularly offensive vehicles only to be told by the Police Department that there are no laws in the Province of Alberta regulating vehicle exhaust emissions. I had intended to write to my MLA about this apparent regulatory deficiency, however, it would appear that the "Clean Air Strategy" is a better forum to raise the issue.

I believe very strongly that there should be some regulations in place to limit the level of vehicle exhaust emissions to within prescribed levels that conform to conventional pollution control standards. I am sure that many people would support this.

The more difficult question is how best to enforce such regulations. I would like to offer a few suggestions.

First, I read an article in the Calgary Herald a few months ago about a device that was being used by the police in Toronto to enforce a vehicle exhaust by-law. Apparently this device (which appeared to be portable) was able to measure the "pollution level" of vehicle exhaust emissions. If the reading exceeds the specified limit, a penalty is presumably imposed. While the details in the newspaper were rather sketchy, it would be worth looking into this in more depth.

Cont'd.

The above process would fit in with the conventional system of police enforcement. In essence, it is no different than the authority vested in the police to stop any car that does not appear to be functioning in a safe manner (i.e. brake lights not working). In addition to any penalties that are imposed, it would also be critical to prohibit further operation of the vehicle until the exhaust problem is rectified.

Another system that I would like to propose would involve drive participation. Under this system, any driver could report the license plate number of any vehicle that he believes to be in breach of the requirements. The police could then arrange to check the vehicle. If it is in breach, the appropriate fine and "fix order" would be issued. If the vehicle is not in breach, the reporting driver would be required to pay a penalty, both to cover the cost of checking and to discourage careless reporting.

A driver participation scheme as outlined above might not result in a lot of reported incidents for a number of reasons including, possibly, general apathy. Such a system would likely, however, have a good self-policing effect. If an offending vehicle owner knows that anybody could report him (rather than just a police officer), he will be more inclined to have his vehicle fixed voluntarily before he is caught.

I hope that these ideas are of some assistance to you and that you are able to come up with a program to effectively reduce vehicle exhaust emissions.

Yours truly,

Mark Wayne

MW/jb

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